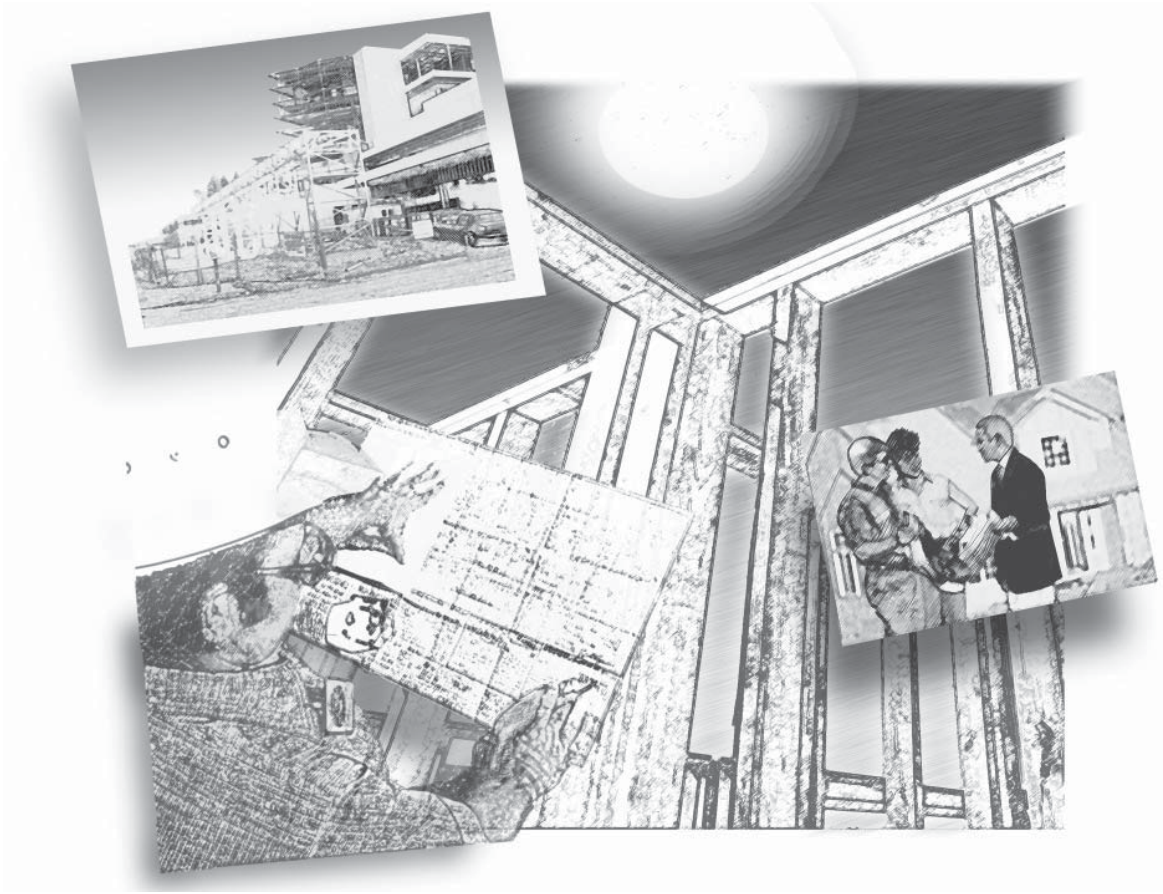
2005 BUILDING ENERGY EFFICIENCY STANDARDS



JOINT APPENDICES

FEBRUARY 2003 – DRAFT

CALIFORNIA ENERGY COMMISSION

CONSULTANT DRAFT REPORT

Workshop Draft 3
February 4, 2003
P400-03-001JA-D
Contract 400-00-061 &
Contract 400-01-023

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February 4, 2003

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ACM I

Glossary

NOTES TO READERS

THIS SECTION CONTAINS A COMPILATION OF THE GLOSSARIES FROM THE RESIDENTIAL AND NONRESIDENTIAL ACM AND COMPLIANCE MANUALS.

THIS GLOSSARY IS A COMMON GLOSSARY FOR BOTH THE RESIDENTIAL AND NONRESIDENTIAL STANDARDS. IT WILL BE PUBLISHED AS ACM APPENDIX I AND WILL BE REFERENCED BY THE RESIDENTIAL AND NONRESIDENTIAL CONSERVATION MANUALS. THE DOCUMENT IS A CONSOLIDATION OF MATERIAL FROM FIVE DOCUMENTS, THE RESIDENTIAL AND NONRESIDENTIAL ACM MANUALS, THE RESIDENTIAL AND NONRESIDENTIAL CONSERVATION MANUALS, AND THE STANDARD.

Term	Definition
ACCA	is the Air-Conditioning Contractors of America.
ACCENT (LIGHT)	is a directional luminaire designed to highlight or spotlight objects. It can be recessed, surface mounted, or mounted to a pendant, stem or track.
ACCEPTANCE REQUIREMENTS FOR CODE COMPLIANCE	is a description of test procedures in the Nonresidential ACM Manual that includes equipment and systems to be tested, functions to be tested, conditions under which the test shall be performed, the scope of the tests, results to be obtained and measurable criteria for acceptable performance.
ACCESSIBLE	is having access thereto, but which first may require removal or opening of access panels, doors, or similar obstructions.
ACM	See *Alternative Calculation Method*.
ACP	See *Alternative Component Package*.
ADDITION	is any change to a building that increases conditioned floor area and conditioned volume. See also, “newly conditioned space.”
AFUE	See *Annual Fuel Utilization Efficiency.*
AGRICULTURAL BUILDING	is a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. It is not a structure that is a place of human habitation, a place of employment where agricultural products are processed, treated or packaged, or a place used by the public
AIR POROSITY	is a measure of the air-tightness of infiltration barriers in units of cubic feet per hour per square foot per inch of mercury pressure difference.
AIRFLOW ACROSS THE EVAPORATOR	is the rate of airflow, usually measured in cfm across a heating or cooling coil. The efficiency of air conditioners and heat pumps is affected by the airflow across the evaporator (or condenser in the case of a heat pump). See also *Thermostatic Expansion Valves (TXV), Evaporator*.
AIR-TO-AIR HEAT EXCHANGER	is a device which will reduce the heat losses or gains which occur when a building is mechanically ventilated, by transferring heat between the conditioned air being exhausted and the unconditioned air being supplied.
ALTERATION	is any change to a building's water heating system, space conditioning system, lighting system, or building envelope that is not an addition.

Term	Definition
ALTERNATIVE CALCULATION METHOD APPROVAL MANUAL OR ACM MANUAL	is the Alternative Calculation Method (ACM) Approval Manual for the 2001 Energy Efficiency Standards for Nonresidential Buildings, (P400-01-011) for nonresidential buildings, hotels, and multi-family residential buildings with four or more stories and the Alternative Calculation Method (ACM) Approval Manual for the 2001 Energy Efficiency Standards for Residential Buildings, (P400-01-012) for all single family and low-rise multi-family residential buildings.
ALTERNATIVE CALCULATION METHODS (ACMS)	are the commission's Public Domain Computer Programs, one of the commission's Simplified Calculation Methods, or any other calculation method approved by the commission.
ALTERNATIVE COMPONENT PACKAGE	is one of the sets of low-rise residential prescriptive requirements contained in § 151(f). Each package is a set of measures that achieve a level of performance, which meets the standards. These are often referred to as the prescriptive packages or packages. "Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements of one of the alternative packages of components shown in Tables 151-B and 151-C for the appropriate climate zone..."
ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE)	is a measure of the percentage of heat from the combustion of gas or oil which is transferred to the space being heated during a year, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.
ANNUNCIATED	is a visual signaling device that indicates the on, off, or other status of a load.
ANSI	is the American National Standards Institute.
APPLIANCE EFFICIENCY REGULATIONS	are the regulations in Title 20, Section 1601 et seq. of the California Code of Regulations.
APPLIANCE STANDARDS	are the California Code of Regulations, Title 20, Chapter 2, Subchapter 4, Article 4, Sections 1601 to 1608.
APPROVED	as to a home energy rating provider or home energy rating system, means reviewed and approved by the Commission under Section 1675.
APPROVED BY THE COMMISSION	"means approval under 25402.1 of the Public Resources Code." [§101].
APPROVED CALCULATION METHOD	is a Public Domain Computer Program approved under Section 10-109 (a), or any Alternative Calculation Method approved under Section 10-109 (b). See *Alternative Calculation Method.* .
AREAL HEAT CAPACITY	is the amount of heat, in Btu, that can be stored per square foot of wall assembly by raising the average temperature of the wall assembly one degree Fahrenheit. See *Heat Capacity.*
ARI	is the Air-Conditioning and Refrigeration Institute.
ASHRAE	is the American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Term	Definition
ASHRAE HANDBOOK OF FUNDAMENTALS	is a reference book published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers which includes industry accepted standard information on thermal properties of materials and HVAC system sizing.
ASME	is the American Society of Mechanical Engineers.
ASTM	is the American Society for Testing and Materials.
ATRIUM	is an opening through two or more floor levels other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning, or other equipment which is enclosed space and not defined as a mall.
ATTIC	is an enclosed unconditioned space directly below the roof and above the ceiling.
AUDITORIUM:	See *Occupancy Type*.
AUTO REPAIR:	See *Occupancy Type*.
AUTOMATIC	is capable of operating without human intervention.
AUTOMATIC MULTI-LEVEL DAYLIGHTING CONTROL	is a multi-level lighting control that automatically reduces lighting in multiple steps in response to available daylight. This control uses one or more photoelectric sensors to detect changes in daylight illumination and then change the electric lighting level in response to the daylight changes.
AUTOMATIC TIME SWITCH CONTROL DEVICES	are devices capable of automatically turning loads off and on based on time schedules.
BACK	indicates the back side of the building as one faces the front facade from the outside (see *Front*). This designation is used on the Certificate of Compliance (CF-1R form) to indicate the orientation of fenestration (e.g., Back-West). See also *East-Facing, South-Facing*, etc.
BANK/FINANCIAL INSTITUTION	See *Occupancy Type*.
BATHROOM	is a room containing a shower, tub, toilet or a sink that is used for personal hygiene.
BELOW GRADE WALL	is the portion of a wall, enclosing conditioned space, that is below the grade line.
BRITISH THERMAL UNIT	is the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit.
BTU	is the British thermal unit.
BTU/H	is the amount of heat in Btu that is removed or added during one hour. Used for measuring heating and cooling equipment output.
BUILDING	is any structure or space for which a permit is sought.
BUILDING ENTRANCE	is any operable doorway in or out of a building, including overhead doors.
BUILDING ENVELOPE	is the ensemble of exterior and demising partitions of a building that enclose conditioned space.

Term	Definition
BUILDING FAÇADE	is the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any reasonable viewing location.
BUILDING LOCATION DATA	refers to specific outdoor design conditions used in calculating heating and cooling loads. Different from the climate zone used for compliance (see *Climate Zone* below), design data includes the typically warmest and coolest outdoor temperatures that a building is likely to experience in an average year in its particular location. Temperatures are from the ASHRAE publication, *SPCDX, Climatic Data for Region X - Arizona, California, Hawaii, Nevada,* May 1982 edition (see Appendix C). For heating, the outdoor design temperature is the Winter Median of Extremes. A higher temperature is permitted, but no lower than this value. For cooling, the outdoor design temperatures must be the 0.5 percent Summer Design Dry Bulb and the 0.5 percent Wet Bulb columns. If a building location is not listed, the local enforcement agency may determine the location for which data is available that is closest in its design characteristics to the actual building site.
BUILDING PERMIT	is an electrical, plumbing, mechanical, building, or other permit or approval, that is issued by an enforcement agency, and that authorizes any construction that is subject to Part 6.

Term	Definition
BUILDING TYPES	refers to the classification of buildings defined by the *UBC* and applicable to the requirements of the *Energy Efficiency Standards.* This manual is concerned with the energy standards that apply to all new low-rise residential buildings, which includes all single-family dwellings and multi-family buildings with three or fewer habitable stories in the entire building. This manual does not consider standards applicable to multi- family buildings with four or more habitable stories in the entire building, hotels, motels and officially designated historical buildings. A multi-family building contains multiple dwelling units that share common walls (single family attached) and may also share common floors or ceilings (apartments). All new residential buildings not in the above low-rise category are covered in the 2001 edition of Energy Commission's *Nonresidential Manual for Compliance with Energy Efficiency Standards* (see Parts 1.1 and 1.2). A single-family building is a single dwelling unit of occupancy group R-3, as defined in the *UBC,* which stands separate and unattached from other dwelling units but may have an attached garage. A multi-family building is a dwelling unit of occupancy group R, as defined in the UBC, that shares a common wall and/or floor/ceiling with at least one other dwelling unit. See Chapter 8 for more information on multi-family energy compliance. A single family attached building is a dwelling unit of occupancy group R that shares a common wall with another dwelling unit. An addition is an extension of or increase in conditioned floor area and volume of a building, which can be new construction or adding space conditioning to an existing space. See Chapter 7 for more information on energy compliance of additions. An existing building is: *"...a building erected prior to the adoption of [the current] code, or one for which a legal building permit has been issued." [UBC, Part II, Section 403*.
CANOPY	is a structure consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.
CAPTIVE-KEY OVERRIDE	is a type of lighting control in which the key that activates the override cannot be released when the lights are in the on position.
CBC	is the 2000 California Building Code prior to the effective date designated by the California Building Standards Commission for the 2003 California Mechanical Code. On and after the effective date designated by the California Building Standards Commission for the 2003 California Mechanical Code, CBC is the 2003 *California Mechanical Code*.
CEILING	is the interior upper surface of a space separating it from the attic, which has a slope less than 60 degrees from horizontal.
CENTER OF GLASS U-VALUE:	is the U-value of that portion of vertical or horizontal fenestration that is inside a two and one half inch band from the frame. Center of glass U-factor is not used

Term	Definition
CERTIFICATE OF COMPLIANCE	is a compliance form that must be completed for both the residential and nonresidential standards. The Certificate of Compliance summarizes all conservation features and devices required for compliance This form must be signed by the designer or person responsible for construction and the building owner. The CF-1R must be included “on” the building plans (*See* § 10-103(a)(2)(A)).
CERTIFICATION	Commission regulations specify that: "Any appliance for which there is a California standard established in the Appliance Efficiency Regulations may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standard for that appliance." [*§*111] See *§*110 and the *Appliance Efficiency Regulations* for further information concerning certification and efficiency requirements for appliances, including refrigerators, water heaters, plumbing fittings and fluorescent lamp ballasts. Directories of certified heating and cooling systems can be accessed or obtained from the CEC. Equipment efficiencies and other specifications listed in the directories can also be obtained by contacting the Commission Energy Hotline or from the Commission’s website at http://www.energy.ca.gov/efficiency/appliances/index.html. The term certification is also used in other ways in the standards. Many of the compliance forms are certificates, whereby installers, HERS testers and others certify that equipment was correctly installed and/or tested.
CERTIFIED	as to a home energy rater, means having been found by a certified home energy rating provider to have successfully completed the requirements established by that home energy rating provider.
CERTIFYING ORGANIZATION	is an independent organization recognized by the Commission to certify manufactured devices for performance values in accordance with procedures adopted by the Commission.
CHANDELIERS	See *Ornamental Chandeliers*.
CIVIC FACILITY	is a city or town hall, courthouse, public administration building, or public service building.
CLASSROOM, LECTURE, OR TRAINING	is a room or area where an audience or class receives instruction. See *Occupancy Type*.
CLIMATE CONTROL SYSTEM	See *Space Conditioning System*.
CLIMATE ZONES	are the 16 geographic areas of California for which the commission has established typical weather data, prescriptive packages and energy budgets. Climate zone boundary descriptions are in the document "California Climate Zone Descriptions" (July 1995), incorporated herein by reference.
CLTD	is the Cooling Load Temperature Difference
CMC	is the 2000 California Mechanical Code prior to the effective date designated by the California Building Standards Commission for the 2003 California Mechanical Code. On and after the effective date designated by the California Building Standards Commission for the 2003 California Mechanical Code, CMC is the 2003 *California Mechanical Code*.

Term	Definition
COEFFICIENT OF PERFORMANCE (COP)	is the ratio of the rate of net heat output to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112. The term is commonly used with electric heat pumps. See also *HSPF, EER, SEER, AFUE*.
COEFFICIENT OF PERFORMANCE (COP), COOLING,	is the ratio of the rate of net heat removal to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.
COEFFICIENT OF PERFORMANCE (COP), HEATING,	is the ratio of the rate of net heat output to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.
COMBINATION SPACE-HEATING AND WATER-HEATING APPLIANCE	"Combination space-heating and water-heating appliance" means an appliance that is designed to provide both space heating and water heating from a single primary energy source.
COMBINED HYDRONIC SPACE/WATER HEATING	is a system which both domestic hot water and space heating is supplied from the same water heating equipment. Combined hydronic space heating may include both radiant floor systems and convective or fan coil systems.
COMMERCIAL AND INDUSTRIAL STORAGE:	See *Occupancy Type*.
COMMISSION	is the California State Energy Resources Conservation and Development Commission.
COMMISSION	is the California State Energy Resources Conservation and Development Commission.
COMPLETE BUILDING	is an entire building with one occupancy making up 90 percent of the conditioned floor area. See also *Entire Building*.
COMPLIANCE APPROACH	is any one of the allowable methods by which the design and construction of a building may be demonstrated to be in compliance with Part 6. The compliance approaches are the performance compliance approach and the prescriptive compliance approach. The requirements for each compliance approach are set forth in Section 100 (d) 2 of Part 6.
COMPLIANCE DOCUMENTATION	are the set of forms and other data prepared in order to demonstrate to the building official that a building complies with the Standards. The compliance forms for the residential and nonresidential standards are contained in the Residential Manual and the Nonresidential Manual.
COMPUTER METHOD COMPLIANCE FORM (C-2R)	is a detailed input report or C-2R form that is generated by the approved program summarizing the input assumptions used in the analysis of the building, if a computer performance method is used for compliance. Approved computer programs automatically generate all required forms.
CONDITIONED FLOOR AREA	is the "conditioned floor area" as defined in Section 101 (b) of

Term	Definition
CONDITIONED FLOOR AREA (CFA)	is the floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.
CONDITIONED FOOTPRINT	is a projection of all conditioned space on all floors to a vertical plane. The conditioned footprint area may be equal to the first floor area, or it may be greater, if upper floors project over lower floors. One way to think of the conditioned footprint area is as the area of the largest conditioned floor in the building plus the conditioned floor area of any projections from other stories that extend beyond the outline of that largest floor.
CONDITIONED SPACE	is space in a building that is either directly conditioned or indirectly conditioned .
CONDITIONED VOLUME	is the total volume (in cubic feet) of the conditioned space within a building.
CONSTRUCTION LAYERS	are roof, wall and floor constructions which represent an assembly of layers. Some layers are homogeneous, such as gypsum board and plywood sheathing, while other layers are non-homogeneous such as the combination of wood framing and cavity insulation typical in many buildings.
CONTROLLED VENTILATION CRAWL SPACE (CVC)	is a crawl space in a residential building where the side walls of the crawlspace are insulated rather than the floor above the crawlspace. A CVC has automatically controlled crawl space vents. Credit for a CVC is permitted for low-rise residential buildings that use the performance approach to compliance.
CONVENTION, CONFERENCE, MULTIPURPOSE AND MEETING CENTERS	is an assembly room, area, or building that is used for meetings, conventions and multiple purposes including, but not limited to, dramatic performances, and that has neither fixed seating nor fixed staging.
CONVENTION, CONFERENCE, OR MEETING CENTER:	See *Occupancy Type*.
COOL ROOF	is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance as specified in Section 118 (i), that reduces heat gain through the roof.
COOL ROOF RATING COUNCIL (CRRC)	is a not-for-profit organization with responsibility to rate and label cool roof products. The CRRC is the supervisory entity designated by the Energy Commission; this authority is granted in §10-113 of the standards.
COOLING EQUIPMENT	is equipment used to provide mechanical cooling for a room or rooms in a building.
COOLING LOAD	is the rate at which heat must be extracted from a space to maintain a desired room condition.
COOLING LOAD TEMPERATURE DIFFERENCE (CLTD)	is an equivalent temperature difference used for calculating the instantaneous external cooling loads across a wall or roof. The cooling load is the CLTD x U-factor x Area.
COP	is the Coefficient of Performance

Term	Definition
CORRIDOR	is a passageway or route into which compartments or rooms open. See *Occupancy Type*.
COURTYARD	is an open space through one or more floor levels surrounded by walls within a building.
COVERED PRODUCT	is an appliance regulated by the efficiency standards established under the National Appliance Energy Conservation Act, 42 U.S.C. Section 6291 et seq.
CRAWL SPACE	is a space immediately under the first floor of a building adjacent to grade.
CRRC	See *Cool Roof Rating Council*.
CRRC-1	is the Cool Roof Rating Council document entitled “Product Rating Program” (2002).
CTI	is the Cooling Tower Institute.
CUSTOM ENERGY BUDGET	See *Energy Budget*.
C-VALUE	(also known as C-factor) is the time rate of heat flow through unit area of a body induced by a unit temperature difference between the body surfaces, in Btu (hr. x ft.^{2} x °F). It is not the same as K-value or K-factor.
DAYLIT AREA	is the space on the floor that is the larger of (a) plus (b), or (c); (a) For areas daylit by vertical glazing, the daylit area has a length of 15 feet, or the distance on the floor, perpendicular to the glazing, to the nearest 60-inch or higher opaque partition, whichever is less; and a width of the window plus either 2 feet on each side, the distance to an opaque partition, or one-half the distance to the closest skylight or vertical glazing, whichever is least. (b) For areas daylit by horizontal glazing, the daylit area is the footprint of the skylight plus, in each of the lateral and longitudinal dimensions of the skylight, the lesser of the floor-to-ceiling height, the distance to the nearest 60-inch or higher opaque partition, or one-half the horizontal distance to the edge of the closest skylight or vertical glazing. (c) The daylit area calculated using a method approved by the Commission.
DAYLIT AREA	is the floor area that is illuminated by daylight through vertical glazing or skylights as specified in Section 131(c).
DECORATIVE GAS APPLIANCE	is a “gas appliance that is designed or installed for visual effect only, cannot burn solid wood, and simulates a fire in a fireplace." [§101]
DEGREE DAY, HEATING	is a unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal annual heating load of a building. For any one day, when the mean temperature is less than 65°F, there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F. The number of degree days for specific geographical locations are those listed in the Residential Manual. For those localities not listed in the Residential Manual, the number of degree days is as determined by the applicable enforcing agency.

Term	Definition
DEMISING PARTITIONS	are barriers that separate conditioned space from enclosed unconditioned space.
DEMISING WALL	is a wall that is a demising partition.
DENSITY	is the mass per unit volume of a construction material as documented in an ASHRAE handbook, a comparably reliable reference or manufacturer's literature.
DEPLETABLE SOURCES	is "[e]nergy obtained from depletable sources is electricity purchased from a public utility, or energy obtained from burning coal, oil, natural gas, or liquefied petroleum gases." [§101]
DESIGN CONDITIONS	are the parameters and conditions used to determine the performance requirements of space-conditioning systems. Design conditions for determining design heating and cooling loads are specified in Section 144 (b) for nonresidential, high-rise residential, and hotel/motel buildings and in Section 150 (h) for low-rise residential buildings.
DESIGN HEAT GAIN RATE	is the total calculated heat gain through the building envelope under design conditions.
DESIGN HEAT LOSS RATE	is the total calculated heat loss through the building envelope under design conditions.
DINING	See *Occupancy Type*.
DIRECTLY CONDITIONED SPACE	is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/(hr.×ft.²), or is provided with mechanical cooling that has a capacity exceeding 5 Btu/(hr.×ft.²), unless the space-conditioning system is designed and thermostatically controlled to maintain a process environment temperature less than 55°F or to maintain a process environment temperature greater than 90°F for the whole space that the system serves, or unless the space-conditioning system is designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperatures below 90°F at design conditions.
DIVIDERS	include muntins; wood, aluminum or vinyl glazing dividers, relative to fenestration,. Dividers may be true divided lights, between the panes, or applied to the exterior or interior of the glazing.
DOCUMENTATION AUTHOR	is the person responsible for preparing the *Compliance Documentation*.
DOMINANT OCCUPANCY	, in mixed occupancy buildings, is the occupancy type with the greatest percentage of total conditioned floor area.
DOOR	See *Exterior Door*.
DORMITORY	is a building consisting of multiple sleeping quarters and having interior common areas such as dining rooms, reading rooms, exercise rooms, toilet rooms, study rooms, hallways, lobbies, corridors, and stairwells, other than highrise residential, lowrise residential, and hotel/motel occupancies.
DOWNLIGHT	is a recessed luminaire, generally less than 1 foot in aperture in the ceiling plane, with direct distribution. Also called "cans" and "top hats".

Term	Definition
DUAL-GLAZED GREENHOUSE WINDOWS	are a type of dual-glazed fenestration product which adds conditioned volume but not conditioned floor area to a building.
DUCT LOSSES	are the mandatory minimum insulation R-value for ducts that carry conditioned air (heated or cooled) through conditioned space is R-4.2, unless the *California Mechanical Code* requires a higher insulation level. The mandatory measures require that ducts be sealed and Package D requires that ducts be diagnostically tested. It is not necessary to test ducts if the performance method is used, but a lower duct efficiency is assumed for the proposed building.
DUCT SEALING	is a procedure for installing a space conditioning distribution system that minimizes leakage of conditioned air. Minimum specifications for installation procedures, materials, diagnostic testing and field verification are contained in the Residential and Nonresidential ACM Approval Manuals.
EA	is Effective Aperture
EAST-FACING	means that a surface is oriented such that its normal is within 45 degrees of true east, including 45°0'0" south of east (SE), but excluding 45°0'0" north of east (NE)." [§101]
ECONOMIZER, AIR	is a ducting arrangement and automatic control system that allows a cooling supply fan system to supply outside air to reduce or eliminate the need for mechanical cooling.
ECONOMIZER, WATER	is a system by which the supply air of a cooling system is cooled directly or indirectly by evaporation of water, or other appropriate fluid, in order to reduce or eliminate the need for mechanical cooling.
ECONOMIZER, WATER,	is a system by which the supply air of a cooling system is cooled directly or indirectly by evaporation of water, or other appropriate fluid, in order to reduce or eliminate the need for mechanical cooling.
EDGE OF GLASS:	is the portion of fenestration glazing that is within two and one half inches of the spacer.
EER	See *Energy Efficiency Ratio.*
EFFECTIVE APERTURE (EA)	is the extent that vertical glazing or skylights are effective for providing daylighting. The effective apperture of vertical glazing is specified in Exception 1 to Section 131(c). The effective apperture for skylights is specified in Section 146(b)4.D.
EFFICACY, LAMP	is the quotient of rated initial lamp lumens divided by the rated lamp power (watts), without including auxiliaries such as ballasts.
EFFICACY, LIGHTING SYSTEM	is the quotient of rated initial lamp lumens times the ballast factor, divided by the input power (watts) to the ballast or other auxiliary device (e.g. transformer); expressed in lumens per watt.
ELECTRIC RESISTANCE HEATING	is a heating system that converts electric energy directly into heat energy by passing a current through an electric resistance. Electric resistance heat is inherently less efficient than gas as a heating energy source because it must account for losses associated with generation from depletable fossil fuels and transmission to the building site.

Term	Definition
ELECTRICAL/ MECHANICAL ROOM	is a room in which the building's electrical switchbox or control panels, and/or HVAC controls or equipment is located.
ELECTRONICALLY-COMMUTATED MOTOR	is a brushless DC motor with a permanent magnet rotor that is surrounded by stationary motor windings, and an electronic controller that varies rotor speed and direction by sequentially supplying DC current to the windings.
ENCLOSED SPACE	"is space that is substantially surrounded by solid surfaces." [§101]
ENERGY BUDGET	is the maximum amount of Time Dependent Valuation (TDV) energy that a proposed building, or portion of a building, can be designed to consume, calculated with the approved procedures specified in Title 24, Part 6.
ENERGY EFFICIENCY RATIO (EER)	is the ratio of net cooling capacity (in Btu/hr.) to total rate of electrical energy (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.
ENERGY EFFICIENCY STANDARDS	are the state energy efficiency standards as set forth in the California Code of Regulations, Title 24, Part 6. See also *Standards*.
ENERGY FACTOR (EF)	is the ratio of energy output to energy consumption of a water heater, expressed in equivalent units, under designated operating conditions over a 24-hour use cycle, as determined using the applicable test method in the Appliance Efficiency Regulations.
ENERGY OBTAINED FROM DEPLETABLE SOURCES	is electricity purchased from a public utility, or any energy obtained from coal, oil, natural gas, or liquefied petroleum gases.
ENERGY OBTAINED FROM NONDEPLETABLE SOURCES	is energy that is not energy obtained from depletable sources.
ENFORCEMENT AGENCY	is the city, county, or state agency responsible for issuing a building permit.
ENTIRE BUILDING	is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure.
ENVELOPE	See *Building Envelope.*
EVAPORATIVE COOLER	provides cooling to a building by either direct contact with water (direct evaporative cooler), no direct contact with water (indirect evaporative cooler), or a combination of direct and indirect cooling (indirect/direct evaporative cooler). The credit offered for evaporative coolers depends on building type and climate.
EXCEPTIONAL METHOD	is when a method may be approved by the Commission if an "alternative calculation method (ACM) analyzes designs, materials, or devices that cannot be adequately modeled using the public domain computer programs. Applications for approval of exceptional methods shall include theoretical and empirical information that verify the method's accuracy, and shall also include the other documentation and fees required by sub§ 10-109(b)." [§10-109(b)4]

Term	Definition
EXECUTIVE DIRECTOR	is the executive director of the commission.
EXERCISE CENTER / GYMNASIUM	See *Occupancy Type*.
EXFILTRATION	is uncontrolled outward air leakage from inside a building, including leakage through cracks and interstices, around windows and doors, and through any other exterior partition or duct penetration.
EXHIBIT	See *Occupancy Type*.
EXPOSED THERMAL MASS	is mass that is directly exposed (uncovered) to the conditioned space of the building. Concrete floors that are covered by carpet are not considered exposed thermal mass.
EXTERIOR DOOR	is a door through an exterior partition that is opaque or has a glazed area that is less than or equal to one-half of the door area. Doors with a glazed area of more than one half of the door area are treated as a fenestration product.
EXTERIOR FLOOR/SOFFIT	is a horizontal exterior partition, or a horizontal demising partition, under conditioned space. For low-rise residential occupancies, exterior floors also include those on grade.
EXTERIOR PARTITION	is an opaque, translucent, or transparent solid barrier that separates conditioned space from ambient air or space that is not enclosed. For low-rise residential occupancies, exterior partitions also include barriers that separate conditioned space from unconditioned space, or the ground.
EXTERIOR ROOF/CEILING	is an exterior partition, or a demising partition, that has a slope less than 60 degrees from horizontal, that has conditioned space below, and that is not an exterior door or skylight.
EXTERIOR ROOF/CEILING AREA	is the area of the exterior surface of exterior roof/ceilings.
EXTERIOR WALL	is any wall or element of a wall, or any member or group of members, which defines the exterior boundaries or courts of a building and which has a slope of 60 degrees or greater with the horizontal plane. An exterior wall or partition is not an exterior floor/soffit, exterior door, exterior roof/ceiling, window, skylight, or demising wall.
EXTERIOR WALL AREA	is the area of the opaque exterior surface of exterior walls.
FENESTRATION AREA	is defined as the area of all fenestration products (i.e., windows, skylights and glass doors) in exterior openings, including the sash or frame area. The nominal area (from nominal dimensions such as 4o4o) or rough opening is also acceptable. For details on calculating fenestration area for glass doors, see *Exterior Door*. Where the term "glazing area" is used in the standards it means the entire fenestration area, not just the area of glazing, unless stated otherwise. See *Fenestration Product*, *Glazing* and *Shading*.
FENESTRATION PRODUCT	is any transparent or translucent material plus any sash, frame, mullions and dividers, in the envelope of a building, including, but not limited to, windows, sliding glass doors, french doors, skylights, curtain walls, garden windows, and other doors with a glazed area of more than one half of the door area.

Term	Definition
FENESTRATION SYSTEM	means a collection of fenestration products included in the design of a building. See *Fenestration Product*.
FIELD-FABRICATED FENESTRATION PRODUCT OR EXTERIOR DOOR	is a fenestration product or exterior door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site- built fenestration with a label certificate or products required to have temporary or permanent labels.
FIREPLACE	is a “hearth and fire chamber or similar prepared place in which a solid fuel fire may be burned, as defined in UBC Section 3102 ; these include but are not limited to factory-built fireplaces, masonry fireplaces, and masonry heaters." [§101].
FLOOR AREA	See *Conditioned Floor Area*.
FLOOR/SOFFIT TYPE	is a floor/soffit assembly having a specific heat capacity, framing type, and U-value.
FOOTPRINT AREA	See *Conditioned Footprint*.
FOSSIL FUELS	are fuels which are derived from natural gas, coal, oil and liquefied petroleum products. These are generally nonrenewable resources, although natural gas may also be produced by other means, such as biomass conversion.
FRAMED PARTITION OR ASSEMBLY	is a partition or assembly constructed using separate structural members spaced not more than 32 inches on center.
FRAMING EFFECTS	is the type and amount of framing in walls, roofs/ceilings and floors which affects the overall U-factor of the surface. For compliance, fixed values for wood framing percentages must be assumed when calculating U-factors.
FRAMING PERCENTAGE	is the fraction of the surface of a partition that is framing as compared to that portion which is cavity.
FRONT	is the primary entry side of the building (front facade) used as a reference in defining the orientation of the building or unit plan. The orientation of the front facade may not always be the same as that for the front door itself.
GAP WIDTH	is the distance between glazings in multi-glazed systems. This is typically measured from inside surface to inside surface, though some manufacturers may report “overall” IG width which is measured from outside surface to outside surface.
GAS COOLING EQUIPMENT	is cooling equipment that produces chilled water or cold air using natural gas or liquefied petroleum gas as the primary energy source.
GAS HEATING SYSTEM	is a natural gas or liquified petroleum gas heating system.
GAS INFILLS	are air, argon, krypton, CO_2, SF_6, or a mixture of these gasses. Gas infills are between the panes of insulated glass units.

Term	Definition
GAS LOG	is a self-contained, free-standing, open-flame, gas-burning appliance consisting of a metal frame or base supporting simulated logs, and designed for installation only in a vented fireplace. See also *Gas Decorative Appliance*
GENERAL COMMERCIAL AND INDUSTRIAL WORK	See *Occupancy Type*.
GENERAL LIGHTING	is lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect. When designed for lower-than-task illuminance used in conjunction with other specific task lighting systems, it is also called "ambient" lighting. See also *Lighting*.
GEOTHERMAL HEAT PUMP	See *Ground Source Heat Pump*.
GLAZING	See *Fenestration Product*.
GLAZING AREA	See *Fenestration Area*.
GOVERNMENTAL AGENCY	is any public agency or subdivision thereof, including, but not limited to, any agency of the state, a county, a city, a district, an association of governments, or a joint power agency.
GREENHOUSE WINDOWS	are a type of fenestration product which adds conditioned volume but no conditioned floor area to a building.
GRILLES	See *Dividers.*
GROCERY STORE	is a room, area, or building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption. See *Occupancy Type*.
GROSS EXTERIOR ROOF AREA	is the sum of the skylight area and the exterior roof/ceiling area.
GROSS EXTERIOR WALL AREA	is the sum of the window area, door area, and exterior wall area.
GROSS SALES FLOOR AREA	is the total area (in square feet) of retail store floor space that is (1) used for the display and sale of merchandise; or (2) associated with that function, including, but not limited to, sales transactions areas, fitting rooms, and circulation areas and entry areas within the space used for display and sale.
GROSS SALES WALL AREA	is the area (in square feet) of the inside of exterior walls and permanent full height interior partitions within the gross sales floor area of a retail store that is used for the presentation of merchandise for sale, less the area of openings, doors, windows, baseboards, wainscots, mechanical or structural elements, and other obstructions preventing the use of the area for the presentation of merchandise.
GROUND FLOOR AREA	is defined as the slab-on-grade area of a slab-on-grade building and the conditioned footprint area of a raised floor building (for compliance with the low-rise residential standards).

Term	Definition
GROUND SOURCE HEAT PUMP	is a heat pump that uses the earth as a source of energy for heating and a sink for energy when cooling. Some systems pump water from an acquifer in the ground and return the water to the ground after transferring heat from or to the water. A few systems use refrigerant directly in a loop of piping buried in the ground. Those heat pumps that use either a water loop or pump water from an aquifer have efficiency test methods that are accepted by the Energy Commission. These efficiency values are certified to the Energy Commission by the manufacturer and are expressed in terms of heating Coefficient of Performance (COP) and cooling Energy Efficiency Ratio (EER).
HABITABLE STORY	is a story that contains space in which humans may work or live in reasonable comfort, and that has at least 50 percent of its volume above grade.
HARD COAT	is a low emissivity metallic coatings applied to glass through a pyrolytic process (at or near the melting point of the glass so that it bonds with the surface layer of glass). Hard coatings are less susceptible to oxidation and scratching as compared to soft coats. Hard coatings generally do not perform as well as soft coats.
HARDSCAPE	includes improvements to a site generally involving paving and/or other structural materials, including but not limited to, curbs, bridges, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, ramps, tunnels, water features and pools, storage or service yards, boat ramps, loading docks, stairs, amphitheaters, outdoor sales lots, and private monuments and statuary.
HC	is Heat Capacity
HEAT CAPACITY (HC)	of an assembly is the amount of heat necessary to raise the temperature of all the components of a unit area in the assembly 1°F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu per square foot per °F. See *Areal Heat Capacity*.
HEAT PUMP	is a device that is capable of heating by refrigeration, and that may include a capability for cooling.
HEATED SLAB FLOOR	is a concrete slab floor or a lightweight concrete topping slab laid over a raised floor, with embedded space heating hot water pipes. The heating system using the heated slab is sometimes referred to as radiant slab floors or radiant heating.
HEATING EQUIPMENT	is equipment used to provide mechanical heating for a room or rooms in a building.
HEATING SEASONAL PERFORMANCE FACTOR (HSPF)	means the total heating output of a central air-conditioning heat pump during its normal usage period for heating, divided by the total electrical energy input in watt-hours during the same period, as determined using the applicable test method in Section 1604(c) of the Appliance Standards.

Term	Definition
HEATING, VENTILATING AND AIR CONDITIONING (HVAC)	is the mechanical heating, ventilating and air conditioning system of the building, also known as the HVAC system. The standards use various measures of equipment efficiency defined according to the type of equipment installed. Gas (fossil fuel) heating equipment is rated according to its Annual Fuel Utilization Efficiency (AFUE). The heating efficiency of electric heat pumps with less than 65,000 Btu/h cooling capacity is rated according to Heating Seasonal Performance Factor (HSPF). The heating efficiency of heat pumps with cooling capacity of 65,000 Btu/h or more is rated according to Coefficient of Performance (COP). Electric resistance heating is rated according to its HSPF. All electric cooling with less than 65,000 Btu/h output capacity is rated according to the Seasonal Energy Efficiency Ratio (SEER). Electric cooling with an output capacity of 65,000 Btu/h or more is rated according to its Energy Efficiency Ratio (EER). (Heat pump cooling is rated according to its SEER or EER, and heat pump heating by the HSPF or COP).
HI	is the Hydronics Institute of the Gas Appliance Manufacturers Association (GAMA).
HIGH BAY	is a space with luminaires 25 feet or more above the floor.
HIGH-RISE RESIDENTIAL BUILDING	is a building, other than a hotel/motel, of Occupancy Group R, Division 1 with four or more habitable stories.
HOME ENERGY RATER	means a person certified to perform the site inspection and data collection, diagnostic testing, and data entry and analysis required to produce a home energy rating.
HOME ENERGY RATING	means a representation on a 0 to 100 scale of the annual source energy efficiency of a building.
HOME ENERGY RATING PROVIDER	means a person or entity that administers an approved home energy rating system.
HOME ENERGY RATING SYSTEM	means a fixed set of procedures, utilizing specifically defined assumptions, measurements and calculations, which produces a home energy rating.
HORIZONTAL GLAZING	See *Skylight*.
HOTEL FUNCTION AREA	See *Occupancy Type*.
HOTEL LOBBY	See *Occupancy Type*.

Term	Definition
HOTEL/MOTEL	is a building or buildings incorporating six or more guest rooms or a lobby serving six or more guest rooms, where the guest rooms are intended or designed to be used, or which are used, rented, or hired out to be occupied, or which are occupied for sleeping purposes by guests, and all conditioned spaces within the same building envelope. Hotel/motel also includes all conditioned spaces which are (1) on the same property as the hotel/motel, (2) served by the same central heating, ventilation, and air-conditioning system as the hotel/motel, and (3) integrally related to the functioning of the hotel/motel as such, including, but not limited to, exhibition facilities, meeting and conference facilities, food service facilities, lobbies, and laundries.
HOUSING	is a building consisting of multiple dwelling units and having interior common areas such as hallways, lobbies, corridors, and stairwells, and/or covered parking.
HSPF	See *Heating Seasonal Performance Factor*.
HVAC	See *Heating, Ventilating and Air Conditioning*.
HVAC SYSTEM	is the "HVAC system" as defined in Section 101 (b) of Part 6. See *Space Conditioning System*.
HYDRONIC SPACE HEATING	is a system that uses water-heating equipment, such as a storage tank water heater or a boiler, to provide space heating. Hydronic space heating includes both radiant floor systems and convective or fan coil systems. See also *Combined Hydronic Space/Water Heating*.
ICBO	is the International Conference of Building Officials.ILLUMINATED FACE is a side of an exit sign that has the word "EXIT" on it.
IG	is Insulating Glass
ILLUMINATED AREA,	as measured in plan view (horizontal plane), is the surface area of building grounds or hardscape within a pattern established by producing a square around a luminaire or pole that is six times the luminaire mounting height, with the luminaire in the middle of the pattern, less any area that is within a building, sign or structure or shadowed by such structure.
ILLUMINATED FACE	is a side of an exit sign that has the word "EXIT" on it.
INDIRECTLY CONDITIONED SPACE	is enclosed space, including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.
INDUCTION (LAMP)	is a fluorescent lamp that does not have electrodes, relying instead on low pressure mercury discharge stimulated by an induced radio frequency field. Also called electrodeless lamps.
INDUSTRIAL (FLUORESCENT) LUMINAIRE	is a fluorescent luminaire with exposed lamp(s) and a metal reflector to direct the light downward.

Term	Definition
INDUSTRIAL (HID) LUMINAIRE	is a high intensity discharge (HID) lamp luminaire consisting of a lampholder, ballast, and metal, glass or plastic reflector to direct the light downward.
INFILTRATION	is uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors, and through any other exterior or demising partition or pipe or duct penetration.
INFILTRATION CONTROLS	is the Infiltration of air, which can be the infiltration of aircontrolled in various ways, many of which are mandatory measures and therefore considered "standard" in new residential construction. Mandatory Infiltration control measures include weatherstripping, caulking, and sealing in and around all exterior joints and openings.
INSULATING GLASS (UNIT)	includes the glazings, spacer(s), films (if any), gas infills, and edge caulking. It does not include the frame.
INTEGRAL	means a part of the assembly or product. A luminaire with an “integral” transformer is a luminaire that has a transformer within the luminaire that powers a low voltage lamp, as contrasted to a luminaire that has a “remote” transformer that is not within the luminaire.
INTEGRATED PART LOAD VALUE (IPLV)	is a single number figure of merit based on part load EER or COP expressing part load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment as determined using the applicable test method in the Appliance Efficiency Regulations or Section 112.
INTERIOR PARTITION	is an interior wall or floor/ceiling that separates one area of conditioned space from another within the building envelope.
IPLV	is the Integrated Part Load Value
ISOLATION DEVICE	is a device that prevents the conditioning of a zone or group of zones in a building while other zones of the building are being conditioned.
KITCHEN/FOOD PREPARATION	See *Occupancy Type*.
KNEE WALL	is a sidewall separating conditioned space from attic space under a pitched roof. Knee walls should be insulated as an exterior wall as specified by the chosen method of compliance.
LANDSCAPE LIGHTING	includes the following: lights recessed into the ground or paving; lights mounted onto the ground and intended to be aimed at landscape features; lights mounted less than 42” tall; or lights mounted onto trees or trellises.
LAUNDRY	is a place where laundering activities occur.
LEFT	indicates the left side of the building as one faces the front facade from the outside.This designation is used on the Certificate of Compliance and other compliance documentation See also *West-Facing*, etc.
LIBRARY	is a repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.

Term	Definition
LIGHTING ZONE,	in outdoor lighting, is a geographic area designated by the California Energy Commission that determines requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ1, LZ2, LZ3 and LZ4.
LIQUID LINE	is the refrigerant line that leads from the condenser to the evaporator in a split system air conditioner or heat pump. The refrigerant is in a liquid state and is at an elevated temperature. This line should not be insulated.
LOCKER/DRESSING ROOM	See *Occupancy Type*.
LOUNGE/RECREATION	See *Occupancy Type*.
LOW BAY	is a space with luminaires less than 25 feet above the floor.
LOW-E COATINGS	are low emissivity metallic coatings applied to glass. See *Soft Coat* and *Hard Coat*.
LOW-RISE ENCLOSED SPACE	is an enclosed space located in a building with 3 or fewer stories.
LOW-RISE RESIDENTIAL BUILDING	is a building, other than a hotel/motel that is of Occupancy Group R, Division 1, and is three stories or less, or that is of Occupancy Group R, Division 3.
LOW-SLOPED ROOF	is a roof that has a ratio of rise to run of 2:12 or less.
LPG	is Liquefied Petroleum Gas.
LUMENS/WATT	A lumen is a measure of the amount of light available from a given light source. A watt is a measure of the power requirement for that light source. The efficacy of a light source is measured by dividing the lumens by the wattage. The more usable light that a light source provides per watt, the greater its energy efficiency. See *Lighting Efficacy*.
LUMINAIRE	is a complete lighting unit consisting of a lamp and the parts designed to distribute the light, to position and protect the lamp, and to connect the lamp to the power supply; commonly referred to as "lighting fixtures" or "instruments."
MAIN ENTRY LOBBY	See *Occupancy Type*.
MALLS AND ARCADES	See *Occupancy Type*.
MANDATORY MEASURES CHECKLIST (MF-1R)	is used by the building plan checker and field inspector to verify compliance of the building with the prescribed list of mandatory features, equipment efficiencies and product certification requirements. The documentation author indicates compliance by initialing, checking, or marking N/A (for features not applicable) in the boxes or spaces provided for the designer.
MANUAL	is capable of being operated by personal intervention.
MANUFACTURED DEVICE	is any heating, cooling, ventilation, lighting, water heating, refrigeration, cooking, plumbing fitting, insulation, door, fenestration product, or any other appliance, device, equipment, or system subject to Sections 110 through 119 of Title 24, Part 6.

Term	Definition
MANUFACTURED FENESTRATION PRODUCT	is a fenestration product constructed of materials which are factory cut or otherwise factory formed with the specific intention of being used to fabricate a fenestration product. A manufactured fenestration product is typically assembled before delivery to a job site. However a "knocked-down" or partially assembled product sold as a fenestration product is also a manufactured fenestration product when provided with temporary and permanent labels as described in Section 10-111; otherwise it is a site-built fenestration product when provided with temporary and permanent labels as described in Section 10-111; otherwise it is a site-built fenestration product. .
MARQUEE	is a permanent lighting system consisting of one or more rows of many small lights.
MECHANICAL COOLING	is lowering the temperature within a space using refrigerant compressors or absorbers, desiccant dehumidifiers, or other systems that require energy from depletable sources to directly condition the space. In nonresidential, high-rise residential, and hotel/motel buildings cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling.
MECHANICAL HEATING	is raising the temperature within a space using electric resistance heaters, fossil fuel burners, heat pumps, or other systems that require energy from depletable sources to directly condition the space.
MEDICAL AND CLINICAL CARE:	See *Occupancy Type*.
METAL BUILDINGS	are a complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin. This does not include structural glass or metal panels such as in a curtainwall system.
MIXED OCCUPANCY	is a building designed and constructed for more than one type of occupancy, such as a three story building with ground floor retail and second and third floor residential apartments.
MODELING ASSUMPTIONS	are the conditions (such as weather conditions, thermostat settings and schedules, internal gain schedules, etc.) that are used for calculating a building's annual energy consumption and that are in the ACM Manuals.
MONOPOINT	is a surface or stem mounted directional luminaire with one lampholder, generally used for accent or display lighting.
MOVABLE SHADING DEVICE	See *Operable Shading Device*.
MULLION	is a vertical framing members separating adjoining window or door sections.
MULTI-FAMILY	is a dwelling unit of occupancy type R, as defined by the *UBC*, sharing a common wall and/or ceiling/floor with at least one other dwelling unit. See also *Building Types*.
MULTI-LEVEL LIGHTING CONTROL	is a lighting control that reduces lighting power in multiple steps while maintaining a reasonably uniform level of illuminance throughout the area controlled.

Term	Definition
MULTISCENE DIMMING SYSTEM	is a lighting control device that has the capability of setting light levels throughout a continuous range, and that has pre-established settings within the range.
MULTI-SCENE DIMMING SYSTEM	is a lighting control device that has the capability of setting light levels throughout a continuous range, and that has pre-established settings within the range.
MUNTINS	See *Dividers.*
MUSEUM	is a space in which works of artistic, historical, or scientific value are cared for and exhibited.
NADIR	is a point on the celestial sphere diametrically opposite the zenith.
NEWLY CONDITIONED SPACE	is any space being converted from unconditioned to directly conditioned, or indirectly conditioned space. Newly conditioned space must comply with the requirements for an addition. See Section 149 for nonresidential occupancies and Section 152 for residential occupancies.
NFRC	is the National Fenestration Rating Council. This is a national organization of fenestration product manufacturers, glazing manufacturers, manufacturers of related materials, utilities, state energy offices, laboratories, home builders, specifiers (architects), and public interest groups. This organization is responsible for rating the U-factors and solar heat gain coefficient of manufactured fenestration products (i.e., windows, skylights, glazed doors) that must be used in compliance calculations. All manufactured fenestration products must be labeled with NFRC rated values or with the default U-factors listed in Table G-4 for compliance with the standards. See also *Fenestration Area* and *Fenestration Product*.
NFRC 100	is the National Fenestration Rating Council document entitled "NFRC 100: Procedure for Determining Fenestration Product U-factors." (November 2002)
NFRC 200	is the National Fenestration Rating Council document entitled "NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence." (November 2002)
NFRC 400	is the National Fenestration Rating Council document entitled "NFRC 400: Procedure for Determining Fenestration Product Air Leakage." (January 2002)
NOMINAL OR NOM.	means dimensions rounded to the nearest foot for convenience or ease of expression.
NONDEPLETABLE SOURCES	, also referred to as renewable energy, including solar and wind power, energy from non-depletable sources is defined as energy that is not obtained from depletable sources.
NONRESIDENTIAL BUILDING	is any building which is a Group A, B, E, F, H, M, or U Occupancy NOTE: Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Title 24, Part 6.

Term	Definition
NONRESIDENTIAL MANUAL	is the manual developed by the Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders and contractors in meeting the energy efficiency requirements for nonresidential, high-rise residential, and hotel/motel buildings.
NORTH-FACING	is oriented to within 45 degrees of true north, including 45o00'00" east of north (NE), but excluding 45°00'00' west of north (NW). This definition applies only to the prescriptive packages and master plans analyzed according to the multiple orientation alternative. In the computer methods the actual building orientation must be used, except in the case of master plans as stated above.
OCCUPANCY SENSOR, LIGHTING	is a device that automatically turns lights off soon after an area is vacated.
OCCUPANCY TYPE	is one of the following: Auditorium is the part of a public building where an audience sits in fixed seating, or a room, area, or building with fixed seats used for public meetings or gatherings not specifically for the viewing of dramatic performances. Auto repair is the portion of a building used to repair automotive equipment and/or vehicles, exchange parts, and may include work using an open flame or welding equipment. Classroom[gwp 38],, lecture, or training is a room or area where an audience or class receives instruction. Commercial and industrial storage is a room, area, or building used for storing items. Convention, conference, multipurpose and meeting centers is an assembly room, area, or building that is used for meetings, conventions and multiple purposes, including, but not limited to, dramatic performances, and that has neither fixed seating nor fixed staging. Corridor is a passageway or route into which compartments or rooms open. Dining is a room or rooms in a restaurant or hotel/motel (other than guest rooms) where meals that are served to the customers will be consumed. Electrical/mechanical room is a room in which the building's electrical switchbox or control panels, and/or HVAC controls or equipment is located. Exercise center/gymnasium is a room or building equipped for gymnastics, exercise equipment, or indoor athletic activities. Exhibit is a room or area that is used for exhibitions that has neither fixed seating nor fixed staging. Financial institution is a public establishment used for conducting financial transactions including the custody, loan, exchange, or issue of money, for the extension of credit, and for facilitating the transmission of funds General commercial and industrial work is a room, area, or building in which an art, craft, assembly or manufacturing operation is performed. High bay: Luminaires 25 feet or more above the floor.

Term	Definition
	Low bay: Luminaires less than 25 feet above the floor.
	Grocery sales is a room, area, or building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.
	Hotel function area is a hotel room or area such as a hotel ballroom, meeting room, exhibit hall or conference room, together with prefunction areas and other spaces ancillary to its function.
	Hotel lobby is the contiguous spaces in a hotel/motel between the main entrance and the front desk, including waiting and seating areas, and other spaces encompassing the activities normal to a hotel lobby function.
	Kitchen/food preparation is a room or area with cooking facilities and/or an area where food is prepared.
	Laundry is a place where laundering activities occur.
	Library is a repository for literary materials, such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.
	Locker/dressing room is a room or area for changing clothing, sometimes equipped with lockers.
	Lounge/recreation is a room used for leisure activities which may be associated with a restaurant or bar.
	Main entry lobby/reception/waiting is the lobby of a building that is directly located by the main entrance of the building and includes the reception area, sitting areas, and public areas.
	Malls, arcades and atria are public passageways or concourses that provides access to rows of stores or shops.
	Medical and clinical care is a room, area, or building that does not provide overnight patient care and that is used to promote the condition of being sound in body or mind through medical, dental, or psychological examination and treatment, including, but not limited to, laboratories and treatment facilities.
	Museum is a space in which works of artistic, historical, or scientific value are cared for and exhibited.
	Office is a room, area, or building of UBC Group B Occupancy other than restaurants.
	Precision commercial or industrial work is a room, area, or building in which an art, craft, assembly or a manufacturing operation is performed involving visual tasks of small size or fine detail such as electronic assembly, fine woodworking, metal lathe operation, fine hand painting and finishing, egg processing operations, or tasks of similar visual difficulty.
	Reception/waiting area is an area where customers or clients are greeted prior to conducting business.
	Religious worship is a room, area, or building for worship.
	Restaurant is a room, area, or building that is a food establishment as defined in Section 27520 of the Health and Safety Code.
	Restroom is a room or suite of rooms providing personal facilities such as

Term	Definition
	toilets and washbasins. Retail merchandise sales is a room, area, or building in which the primary activity is the sale of merchandise. School is a building or group of buildings that is predominately classrooms and that is used by an organization that provides instruction to students. Shopping center building is a multiple tenant building intended to house retail and service type occupancies. Stairs, active/inactive, is a series of steps providing passage from one level of a building to another. Support area is a room or area used as a passageway, utility room, storage space, or other type of space associated with or secondary to the function of an occupancy that is listed in these regulations. Theater, motion picture, is an assembly room, a hall, or a building with tiers of rising seats or steps for the showing of motion pictures. Theater, performance, is an assembly room, a hall, or a building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events and similar live performances. Vocational room is a room used to provide training in a special skill to be pursued as a trade. Wholesale showroom is a room where samples of merchandise are displayed.
OFFICE	See *Occupancy Type*.
OPERABLE SHADING DEVICE	is a device at the interior or exterior of a building or integral with a fenestration product, which is capable of being operated, either manually or automatically, to adjust the amount of solar radiation admitted to the interior of the building.
OPTIMAL OVERHANG	is an overhang that completely shades the glazing at solar noon on August 21 and substantially exposes the glass at solar noon on December 21.
ORNAMENTAL CHANDELIERS	are ceiling-mounted, close-to-ceiling, or suspended decorative luminaires that use glass, crystal, ornamental metals, or other decorative material and that typically are used in hotel/motels, restaurants, or churches as a significant element in the interior architecture.
ORNAMENTAL LIGHTING	includes post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquees.
OUTDOOR AIR	is air taken from outdoors and not previously circulated in the building.
OUTDOOR LIGHTING	refers to all electrical lighting for parking lots, buildings and grounds, signs, building entrances, outdoor sales areas, outdoor canopies. Outdoor lighting is sometimes referred to as exterior lighting.
OUTDOOR SALES FRONTAGE	is the portion of the perimeter of an outdoor sales area immediately adjacent to a street, road, or public sidewalk.

Term	Definition
OUTDOOR SALES LOT	is an uncovered paved area specifically for the display of vehicles, equipment, or other objects for sale, including internal access drive and walkway areas. Adjacent service or storage areas shall not be included in the sales lot area, but shall be considered hardscape.
OUTSIDE AIR	See *Outdoor Air*
OVERALL HEAT GAIN	is the value obtained in Section 143(b)2 for determining compliance with the component envelope approach.
OVERALL HEAT LOSS	is the value obtained in Section 143(b)1 for determining compliance with the component envelope approach.
PACKAGED AIR CONDITIONER	combines both the condenser and air handling capabilities in a single enclosure or package.
PARKING GARAGE	is a covered building or structure for the purpose of parking vehicles , which consists of at least a roof over the parking area, often with walls on one or more sides. Parking garages may have fences or rails in place of one or more walls. The structure has an entrance(s) and exit(s), and includes areas for vehicle maneuvering to reach the parking spaces. If the roof of a parking structure is also used for parking, the section without an overhead roof is considered a parking lot instead of a parking garage.
PART 6	is the California Code of Regulations, Title 24, Part 6.
PAVED AREA	is an area that is paved with concrete, asphalt, stone, brick, gravel, or other improved wearing surface.
PENDANT	is a mounting method for a luminaire in which the luminaire is suspended from above.
PERM	is defined as equal to 1 grain of water vapor transmitted per 1 square foot per hour per inch of mercury pressure difference.
PHOTOELECTRIC SWITCH	is an electric switch that detects changes in illumination then switches its electric load at predetermined illumination levels. Also called a "photocell."
PLENUM	is an air compartment or chamber, including uninhabited crawl space, areas above a ceiling or below a floor, including air spaces below raised floors of computer/data processing centers, or attic spaces, to which one or more ducts are connected and which forms part of either the supply-air, return-air or exhaust air system, other than the occupied space being conditioned.
POOR QUALITY LIGHTING TASKS	are visual tasks that require Illuminance Category E or greater, because of the choice of a writing or printing method that produces characters that are of small size or lower contrast than good quality alternatives that are regularly used in offices.
PRECISION COMMERCIAL OR INDUSTRIAL WORK	See *Occupancy Type*.
PRINCIPAL VIEWING LOCATION	is anywhere along the adjacent highway, street, road or sidewalk running parallel to an outdoor sales frontage

Term	Definition
PRIVATE OFFICE OR WORK AREA	is an office bounded by 72-inch or higher permanent partitions and is no more than 200 square feet.. See *Occupancy Type*.
PROCESS	is an activity or treatment that is not related to the space conditioning, lighting, service water heating, or ventilating of a building as it relates to human occupancy.
PROCESS LOAD	is a load resulting from a process.
PROPOSED DESIGN	is the proposed building design which must comply with the standards before receiving a building permit. See also Energy Budget and Standard Design.
PUBLIC ADVISER	is the Public Adviser of the commission.
PUBLIC AREAS	are spaces generally open to the public at large, customers, congregation members, or similar spaces, where occupants need to be prevented from controlling lights for safety, security, or business reasons.
PUBLIC FACILITY RESTROOM	is a restroom designed for use by the public.
PUBLIC MONUMENTS	are statuary, buildings, structures, and/or hardscape on public land.
RADIANT BARRIER	is any reflective material that has an emittance of 0.05 or less, tested in accordance with ASTM C-1371 or ASTM E408, and that is certified to the California Department of Consumer Affairs as required by CCR, Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.
RAISED FLOOR	is a floor (partition) over a crawl space, or an unconditioned space, or ambient air.
RCR	See *Room Cavity Ratio*.
READILY ACCESSIBLE	is capable of being reached quickly for operation, repair or inspection, without requiring climbing or removing obstacles, or resorting to access equipment.
REAR	See *Back*.
RECEPTION/WAITING AREA	See *Occupancy Type*
RECOOL	is the cooling of air that has been previously heated by space conditioning equipment or systems serving the same building.
RECORD DRAWINGS	include, but are not be limited to, the location of and performance data on each piece of equipment, the layout of ducts and pipe distribution systems, including sizes, and the space conditioning system terminal air and water design and measured flow rates.
RECOVERED ENERGY	is energy used in a building that (1) is mechanically recovered from space conditioning, service water heating, lighting, or process equipment after the energy has performed its original function; (2) provides space conditioning, service water heating, or lighting; and (3) would otherwise be wasted.

Term	Definition
RECOVERY EFFICIENCY	is one measure of the efficiency of water heaters. It is required for water heating energy calculations for some types of water heaters (see Chapter 6). It is "a measure of the percentage of heat from combustion of gas or oil which is transferred to the water. For non-storage type water heaters, the recovery efficiency is really a thermal efficiency." [*AER*, Section 1602]
REDUCED FLICKER OPERATION	is the operation of a light, in which the light has a visual flicker less than 30% for frequency and modulation.
REFERENCE COMPUTER PROGRAM	is the reference method against which other methods are compared. For the nonresidential standards, the reference computer program is DOE 2.1E program, version 86. For the low-rise residential standards the reference computer program is CALRES Version __.
REFRIGERANT CHARGE	refers to the amount of refrigerant that is installed or "charged" into an air conditioner or heat pump. The refrigerant is the working fluid. It is compressed and becomes a liquid as it enters the condenser. The hot liquid is cooled in the condenser and flows to the evaporator where it released through the expansion valve. When the pressure is released, the refrigerant expands into a gas and cools. Air is passed over the evaporator to provide the space cooling. When an air conditioner or heat pump has too much refrigerant (overcharged) the compressor may be damaged. When an air conditioner has too little refrigerant (undercharged), the efficiency of the unit is reduced. A *thermostatic expansion valve (TXV)* can mitigate the impact of improper refrigerant charge.
REHEAT	is the heating of air that has been previously cooled by cooling equipment or systems or an economizer.
RELATIVE SOLAR HEAT GAIN	is the ratio of solar heat gain through a fenestration product (corrected for external shading) to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.
RELIGIOUS WORSHIP	See *Occupancy Type*.
RELOCATABLE CLASSROOM (RC) PUBLIC SCHOOL BUILDING	is any classroom in a relocatable building as defined by Title 24, Part 1, Section 4-314, which is subject to Title 24, Part 1, Chapter 4, Group 1.
REPAIR	is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. NOTE: Repairs to low-rise residential buildings are not within the scope of these standards.
RESIDENTIAL BUILDING	See *High-Rise Residential Building and Low-Rise Residential Building*.
RESIDENTIAL MANUAL	is the manual developed by the commission, under Section 25402.1 of the Public Resources Code, to aid designers, builders, and contractors in meeting energy efficiency standards for low-rise residential buildings.
RESTAURANT	See *Occupancy Type*.
RESTROOM	See *Occupancy Type*.
RETAIL AND SALES	See *Occupancy Type*.

Term	Definition
RIGHT	indicates the right side of the building as one faces the front facade from the outside (see *Front*). This designation is used to indicate the orientation of fenestration and other surfaces, especially in model homes that are constructed in multiple orientations.
ROOF	See *Exterior Roof/Ceiling*.
ROOF/CEILING TYPE	is a roof/ceiling assembly having a specific framing type and U-factor.
ROOM CAVITY RATIO (RCR)	for rectangular rooms $RCR = \frac{5 \times H \times (L + W)}{L \times W}$ for irregular shaped rooms $RCR = \frac{2.5 \times H \times P}{A}$ where: L = Length of room W = Width of room H = Vertical distance from the work plane to the center line of the lighting fixture P = Perimeter of room A = Area of room
RUNOUT	is piping that is no more than 12 feet long and that is connected to a fixture or an individual terminal unit.
R-VALUE	(of insulation or any material or building component) is the measure of its thermal resistance expressed in ft²-hr ºF/Btu. See *Thermal Resistance*
SALES CANOPY	is a canopy specifically to cover and protect an outdoor sales area.
SC	See *Shading Coefficient.*
SCHOOL:	See *Occupancy Type*.
SCONCE	is a wall mounted ornamental luminaire.
SEASONAL ENERGY EFFICIENCY RATIO (SEER)	means the total cooling output of a central air conditioner in Btu during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.
SEER	See *Seasonal Energy Efficiency Ratio*
SEMICONDITIONED SPACE	is an enclosed nonresidential space that is provided with wood heating, cooling by direct or indirect evaporation of water, mechanical heating that has a capacity of 10 Btu/(hr.×ft.²) or less, mechanical cooling that has a capacity of 5 Btu/(hr.×ft.²) or less, or is maintained for a process environment as set forth in the definition of *Directly Conditioned Space*.

Term	Definition
SENIOR HOUSING	is housing specifically for senior living, including independent living quarters, and assisted living quarters, skilled nursing quarters, and/or dementia quarters. Commons areas may include dining, reading, study, library or other community spaces and/or medical treatment or hospice facilities.
SERIES FAN-POWERED TERMINAL UNIT	is a terminal unit that combines a VAV damper in series with a downstream fan which runs at all times that the terminal unit is supplying air to the space.
SERVICE WATER HEATING	is heating of water for sanitary purposes for human occupancy, other than for comfort heating.
SHADING	is the protection from heat gains because of direct solar radiation by permanently attached exterior devices or building elements, interior shading devices, glazing material, or adherent materials. Permanently attached means (a) attached with fasteners that require additional tools to remove (as opposed to clips, hooks, latches, snaps, or ties); or (b) required by the CBC for emergency egress to be removable from the interior without the use of tools.
SHADING COEFFICIENT (SC)	is the ratio of the solar heat gain through a fenestration product to the solar heat gain through an unshaded 1/8 inch thick clear double strength glass under the same set of conditions. For nonresidential, high-rise residential, and hotel/motel buildings, this shall exclude the effects of mullions, frames, sashes, and interior and exterior shading devices. See also *Solar Heat Gain Coefficient*.
SIDE FINS	are vertical shading elements mounted on either side of a glazed opening that can protect the glazing from lateral low angle sun penetration.
SIGN AREA	is the illuminated area of a sign. The area of a panel sign includes all the area of the message panel. The area of a multifaceted sign is calculated at 90° to each face or planar surface.
SIGN, CHANNEL	is an internally illuminated sign with multiple components, each built in the shape of an individual letter or symbol, with a separate translucent panel over the light source for each element. The completed sign consists of an assemblage of individual letters or symbols, each independently illuminated. Also referred to as a channel letter sign.
SIGN, EXTERNALLY ILLUMINATED	is any sign or a billboard that is lit by a light source that is external to the sign.
SIGN, INTERNALLY ILLUMINATED	is a panel or channel sign with an internal light source where the message area is luminous.
SIGN, PANEL	is an internally illuminated sign, with a continuous translucent message panel, also referred to as a cabinet sign.
SIGN, UNFILTERED	is an internally illuminated sign where the viewer perceives the light source directly as the message, without any colored filter between the viewer and the light source, including neon, cold cathode, and LED signs.
SINGLE FAMILY ATTACHED`	is a multi-family building whose dwelling units share common walls but do not share any common floors/ceilings is considered Single Family Attached. See *Building Types*.

Term	Definition
SINGLE FAMILY DETACHED	is a single dwelling unit of occupancy type R, as defined in the *UBC*, which stands separate and unattached from other dwelling units, but may have an attached garage. A dwelling unit that is separated only by a property line and double wall construction (with a space between the walls) from another dwelling unit and that shares no common floor/ceiling is also treated as single family.
SITE SOLAR ENERGY	is natural daylighting, or thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.
SITE-ASSEMBLED FENESTRATION	includes both *field-fabricated* fenestration and *site-built* fenestration.
SITE-BUILT FENESTRATION PRODUCT	is a fenestration product designed to be field glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units that are manufactured with the intention of being assembled at the construction site and are provided with an NFRC label certificate for site built products. Examples of site-built fenestration products include storefront systems, curtain walls, and atrium roof systems.
SKYLIGHT	is glazing having a slope less than 60 degrees from the horizontal with conditioned space below.
SKYLIGHT AREA	is the area of the rough opening for the skylight.
SKYLIGHT TYPE	is a type of skylight assembly having a specific solar heat gain coefficient and U-factor, whether glass mounted on a curb, glass not mounted on a curb or plastic (assumed to be mounted on a curb).
SLAB-ON-GRADE	is an exterior concrete floor in direct contact with the earth below the building.
SMACNA	is the Sheet Metal and Air-conditioning Contractors National Association
SMALL SPACE	is a room less than 60 square feet, not intended for normal occupancy, and used for storage, mechanical or electrical equipment, or janitorial support.
SOFT COAT	is applied to glass through a sputter process where molecules of metals such as stainless steel or titanium are sputtered onto the surface of glass. Soft coats generally perform better than hard coats, but are more susceptible to oxidation and degradation through handling or storing.
SOLAR HEAT GAIN COEFFICIENT (SHGC)	is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.
SOURCE ENERGY	was used in previous versions of the standard (prior to 2005) to compare the energy performance of buildings. Source energy accounts for all of the energy used in delivering energy to the building site including power generation, transmission losses and distribution. Electricity (kWh) is converted to source energy (Btu) at the rate of 10,239 Btu per kilowatt-hour (3 times 3,413). This assumes that only a third of the energy used to produce electricity is actually delivered to a building in a usable form.By contrast, fossil fuels such as natural gas, propane and oil may be used directly at the building site, so that source energy equals end-use energy. Natural gas used directly at the building site is converted to source energy at the rate of 100,000 Btu per therm.

Term	Definition
SOUTH-FACING	is oriented to within 45 degrees of true south including 45°00'00" west of south (SW), but excluding 45°00'00" east of south (SE).
SPA	is a vessel that contains heated water, in which humans can immerse themselves, is not a pool, and is not a bathtub.
SPACE CONDITIONING SYSTEM	is a system that provides either collectively or individually heating, ventilating, or cooling within or associated with conditioned spaces in a building. The system may operate alone or in conjunction with other systems. See *Heating, Ventilating and Air Conditioning*.
SPACERS: "INSULATING"	are non-metallic, fairly non-conductive materials, usually of rubber compounds that are used to separate panes of glass in an insulated glass unit.
SPACERS: ALUMINUM	is a metal channel that is used either against the glass (sealed along the outside edge of the insulated glass unit), or separated from the glass by one or more beads of caulk.
SPACERS: OTHERS	is wood, fiberglass, or composite materials that are used as spacers between panes of glass in insulated glass units.
SPACERS: SQUIGGLE	is a flexible material, usually butyl, formed around a thin corrugated aluminum strip that is used as a spacer in insulated glass units.
SPECIFIC HEAT	is the quantity of heat that must be added to a unit mass of a material to increase its temperature by one degree . Typical units are Btu/ºF-lb.
SPLIT SYSTEM AIR CONDITIONER OR HEAT PUMP	has physically separate condenser and air handling units that work together as a single cooling system.
STAIRS	See *Conditioned Floor Area*.
STAIRS, ACTIVE / INACTIVE	See *Occupancy Type*.
STANDARD DESIGN	is a hypothetical building that is used to calculate the custom budget for nonresidential and residential buildings. A new building or addition alone complies with the standards if the predicted source energy use of the *proposed design* is the same or less than the annual budget for space conditioning and water heating of the *standard design*. The standard design is defined in the residential and nonresidential ACM manuals and is substantially similar to the proposed design, except it is in exact compliance with the prescriptive requirements and the mandatory measures.
STANDARDS	are the Building Energy Efficiency Standards contained in Title 24, Part 6.
STANDBY LOSS	is the ratio of heat lost per hour to the heat content of the stored water above room temperature. It is one of the measures of efficiency of water heaters required for water heating energy calculations for some types of water heaters. Standby loss is expressed as a percentage. [*AER*, Section 1602]
STRIP LIGHT	is a fluorescent luminaire consisting of a metal ballast housing and exposed lamp(s).

Term	Definition
SUBORDINATE OCCUPANCY	is any occupancy type, in mixed occupancy buildings, that is not the dominant occupancy. See also *Dominant Occupancy, Mixed Occupancy*.
SUCTION LINE	is the refrigerant line that leads from the evaporator to the condenser in a split system air conditioner or heat pump. This line is typically insulated since it carries refrigerant at a low temperature.
SUPPORT AREA	See *Occupancy Type*.
SUPPORT SPACE	See *Occupancy Type*.
SUSPENDED FILMS	are low-e coated plastic films stretched between the elements of the spacers between panes of glazing; acts as a reflector to slow the loss of heat from the interior to the exterior.
SYSTEM	is a combination of equipment, controls, accessories, interconnecting means, or terminal elements by which energy is transformed to perform a specific function, such as space conditioning, service water heating, or lighting.
TASK-ORIENTED LIGHTING	is lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location. See also *Lighting*, *General Lighting*.
TDV ENERGY	is the time varying energy caused to be used at by the building to provide space conditioning and water heating and for specified buildings lighting, accounting for the energy used at the building site andconsumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.
TEMPORARY LIGHTING	is a lighting installation where temporary connections, such as cord and plug, are used for electric power.
TENANT LEASE SPACE	is a lighting installation where temporary connections, such as cord and plug, are used for electric power.
THEATER, MOTION PICTURE	See *Occupancy Type*.
THEATER, PERFORMANCE:	See *Occupancy Type*.
THERMAL BREAK WINDOW FRAME	is metal fenestration frames that are not solid metal from the inside to the outside, but are separated in the middle by a material, usually urethane, with a lower conductivity.
THERMAL CONDUCTIVITY	is the quantity of heat that will flow through a unit area of the material per hour when the temperature difference through the material is one degree.
THERMAL MASS	is solid or liquid material used to store heat for later heating use or for reducing cooling requirements.
THERMAL RESISTANCE (R)	is the resistance of a material or building component to the passage of heat in (hr. x ft.^{2} x ^{o}F)/Btu.

Term	Definition
THERMAL RESISTANCE (R-VALUE))	is "the [thermal] resistance of a material or building component to the passage of heat in (h-ft^2-ºF)/Btu." [§101] The R-value indicates how well a material prevents heat from flowing through it. R-19 insulation, for example, is only half as effective at slowing heat transfer as R-38 insulation. When more than one material is put in series with another in a construction assembly (such as exterior siding, insulation and interior gypsum board), the thermal resistance of the assembly is equal to the sum of the individual resistances. See also U-factor.
THERMOSTATIC EXPANSION VALVE (TXV)	is a refrigerant metering valve, installed in an air conditioner or heat pump, which controls the flow of liquid refrigerant entering the evaporator in response to the superheat of the gas leaving it.
THROW DISTANCE	is the distance between the luminaire and the center of the plane lit by the luminaire on a display.
TIME DEPENDENT VALUATION (TDV) ENERGY	is the time varying energy caused to be used at by the building to provide space conditioning and water heating and for specified buildings lighting, accounting for the energy used at the building site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.
TITLE 24	, also known as the *State Building Code*, published in Title 24 of the *California Code of Regulations*. The *Energy Efficiency Standards* are contained in Part 6. Part 1 includes the administrative requirements of the standards.
TRAFFIC SIGN	is for signing traffic direction, warning, and roadway identification.
TROFFER	is a recessed luminaire forming an inverted trough serving as a support and reflector , often installed in a suspended grid ceiling system.
TUNING	is a lighting control device that allows authorized personnel only to select a single light level within a continuous range.
UBC	is the 1994 edition of the state-adopted *Uniform Building Code™.* See *CBC.*
U-FACTOR	is the overall coefficient of thermal transmittance of a construction assembly, in Btu/(hr. x ft.² x ºF), including air film resistance at both surfaces.
UIMC	is the Unit Interior Mass Capacity
UL®	is the Underwriters Laboratory®.
UNCONDITIONED SPACE	is enclosed space within a building that is not directly conditioned or indirectly conditioned.
UNIT INTERIOR MASS CAPACITY (UIMC)	is the amount of effective heat capacity per unit of thermal mass, taking into account the type of mass material, thickness, specific heat, density and surface area. See also *Thermal Mass*.
UPLIGHT	is a luminaire designed to be suspended from a ceiling or mounted onto a wall or other structure, and from which the majority of the light is directed upwards to illuminate the ceiling.

Term	Definition
U-VALUE	See *U-factor*.
VANITY	is a sink and mirror combination in a toilet or bathroom.
VAPOR BARRIER	is a material that has a permeance of one perm or less and that provides resistance to the transmission of water vapor.
VARIABLE AIR VOLUME (VAV) SYSTEM	is a space conditioning system that maintains comfort levels by varying the volume of conditioned air to the zones served.
VEHICLE SERVICE STATION CANOPY	is a canopy above gasoline or diesel dispensing stations.
VENTILATION AIR	is that portion of supply air which comes from outside plus any recirculated air that has been treated to maintain the desired quality of air within a designated space. See also *outside air*.
VERTICAL GLAZING	See *Window*.
VERY VALUABLE MERCHANDISE	is rare or precious objects, including, but not limited to, jewelry, coins, small art objects, crystal, china, ceramics, or silver, the selling of which involves customer inspection of very fine detail from outside of a locked case.
VINYL WINDOW FRAME	is a fenestration frame constructed with a polyvinyl cloride (PVC) which has a lower conductivity than metal and a similar conductivity to wood.
VISIBLE LIGHT TRANSMITTANCE (VLT)	is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing material to the light that strikes the material.
VLT	is Visible Light Transmission.
VOCATIONAL ROOM	See *Occupancy Types*.
WALL TYPE	is a wall assembly having a specific heat capacity, framing type, and U-factor.
WALLWASHER	is a luminaire with an asymmetric distribution designed to illuminate a wall with an even “wash” of light. Can be recessed, surface mounted, or mounted to a pendant, stem or track.
WEATHERSTRIPPING	is specially designed strips, seals and gaskets attached to doors and windows to prevent infiltration and exfiltration through cracks around the openings. Weatherstripping is one of the mandatory requirements for all new residential construction. See *Infiltration, Exfiltration*.

Term	Definition
WEIGHTED AVERAGING	is whenever two or more types of a building feature, material or construction assembly occur in a building, a weighted average of the different types must be calculated. Weighted averaging is simply a mathematical technique for combining different amounts of various components into a single number. Weighted averaging is frequently done when there is more than one level of floor, wall, or ceiling insulation in a building, or more than one type of shading device on windows. Area-weighted R-values are never used; only area weighted U-factors. The formula for weighted averaging (WA) is: $$WA = \frac{Area_1 \times Value_1 + Area_2 \times Value_2 + Area_3 \times Value_3 + ... + Area_n \times Value_n}{\text{Total Area}}$$ "Area" can be replaced throughout the formula by "Length" or any other unit of measure used for the value being averaged. "Value" can be replaced throughout the formula by "U-factor," "Solar Heat Gain Coefficient," or any other value which varies throughout a residence and is appropriate to weight average. It is incorrect to area-weight different R-values. Only U-factors can be area-weighted.
WEST-FACING	is oriented to within 45 degrees of true west, including 45°00'00" north of due west (NW), but excluding 45°00'00" south of west (SW).
WHOLESALE SHOWROOM:	See *Occupancy Type*.
WINDOW	is glazing that is not a skylight.
WINDOW AREA	is the area of the surface of a window, plus the area of the frame, sash, and mullions.
WINDOW TYPE	is a window assembly having a specific solar heat gain coefficient, relative solar heat gain, and U-factor.
WINDOW WALL RATIO	is the ratio of the window area to the gross exterior wall area.
WOOD HEATER	is an enclosed wood burning appliance used for space heating and/or domestic water heating, and which meets the definition in Federal Register, Volume 52, Number 32, February 18, 1987.
WOOD STOVE	See *Wood Heater*.
WRAPAROUND	is a surface mounted or suspended fluorescent luminaire employing linear lamps and a lens or diffuser that shields the lamp on the bottom and long sides.
ZONAL CONTROL	refers to the practice of dividing a residence into separately controlled HVAC zones. This may be done by installing multiple HVAC systems that condition a specific part of the building, or by installing one HVAC system with a specially designed distribution system that permits zonal control. The Energy Commission has approved an exceptional method for analyzing the energy impact of zonally controlled space heating and cooling systems. See also *Zone*.

Term	Definition
ZONE, LIGHTING	is a space or group of spaces within a building that has sufficiently similar requirements so that lighting can be automatically controlled in unison throughout the zone by an illumination controlling device or devices, and does not exceed one floor.
ZONE, SPACE CONDITIONING	is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions, as specified in Section 144 (b) 3 or 150 (h), as applicable, can be maintained throughout the zone by a single controlling device.

ACM II

Reference Weather/Climate Data

Figure II.1 – Climate Zone Map

NOTES TO READERS

THIS SECTION CONTAINS A COMPILATION OF THE CLIMATE INFORMATION FROM THE RESIDENTIAL AND NONRESIDENTIAL ACM AND COMPLIANCE MANUALS.

II.1 Weather Data - General

All energy calculations used for compliance with the Standards must use the Commission's sixteen (16) official hourly weather files. These files are available in electronic form from the Commission in the WYEC2 (Weather Year for Energy Calculations) format and in DOE 2.1E packed weather data format. Temperatures in the WYEC2 files for the sixteen climate zones have been adjusted to the average means and extremes of the weather data of the reliable substations in each climate zone.[1] The WYEC2 data may be adjusted for local conditions, condensed, statistically summarized or otherwise reduced, as long as:

1. The weather data used to derive the simplified or reduced data is the Commission's official hourly weather data; and,
2. The ACM program meets all of the certification tests using the reduced weather data.

Whatever weather data and/or weather data reduction methods are used, ACM approval is contingent upon approved weather data being used for all compliance runs.

There are 16 climate zones, each with 8,760 hourly records containing raw data on a variety of ambient conditions such as:

- Dry bulb temperature
- Wet bulb temperature
- Wind speed and direction
- Direct solar radiation
- Diffuse radiation

Each climate zone file includes the non-temperature data of a particular city whose annual climate data has been judged representative of the construction locations within that zone. The values listed by climate zone and the nominal city location for each climate zone in Table II.3 in this section must be used for any given climate zone if the ACM does not automatically make local city weather adjustments to the files.

As indicated above the reference method uses local city ASHRAE design data to adjust the climate zone weather data. These adjustments customize the temperature data, especially the extremes, to conform to the ASHRAE design data statistics for the city in question. This makes the HVAC sizing and energy calculations more realistic for energy compliance simulations.

[1] See *Climate Zone Weather Data Analysis and Revision Project*, Final Consultant Report, CEC Publication # P400-92-004, for more detail.

Table II-1 –California Climate Zone Summary

Climate Zone	City	Latitude	Longitude	Elevation
1	Arcata	40.8	124.2	43
2	Santa Rosa	38.4	122.7	164
3	Oakland	37.7	122.2	6
4	Sunnyvale	37.4	122.4	97
5	Santa Maria	34.9	120.4	236
6	Los Angeles AP	33.9	118.5	97
7	San Diego	32.7	117.2	13
8	El Toro	33.6	117.7	383
9	Burbank	34.2	118.4	655
10	Riverside	33.9	117.2	1543
11	Red Bluff	40.2	122.2	342
12	Sacramento	38.5	121.5	17
13	Fresno	36.8	119.7	328
14	China Lake	35.7	117.7	2293
15	El Centro	32.8	115.6	-30
16	Mt. Shasta	41.3	122.3	3544

II.2 Counties and Cities with Climate Zone Designations

The following pages are a listing of California counties and cities with a climate zone designation for each. This information represents an abridged version of the Commission publication *California Climate Zone Descriptions* which contains detailed survey definitions of the sixteen climate zones.

Table II-2 – Counties and Cities with Climate Zone Designations

City	CZ
Alameda County (Zones 3, 12)	
Alameda	3
Albany	3
Altamont	12
Ashland	3
Berkeley	3
Calaveras Reservoir	12/4
Castro Valley	3
Cherryland	3
Corral Hollow	12
Dublin	12
Emeryville	3
Fremont	3
Hayward	3
Lake Del Valley	12
Livermore	12
Midway	12
Mount Eden	3
Newark	3
Oakland AP	3
Piedmont	3
Pleasanton	12
San Antonio Reservoir	12
San Leandro	3
San Lorenzo	3
Sunol	12
U.S.N. Air Station,	3
U.S.N. Supply Center,	3
Union City	3
Upper San Leandro	3
Alpine County (Zone16)	
Caples Lake	16
Carson River (East Fork)	16
Carson River (West Fork)	16
Ebbetts Pass	16
Freel Peak	16
Grover Hot Springs	16
Highland Peak	16
Lake Alpine	16
Markleeville	16
Woodfords	16
Amador County (Zones 12, 16)	
Amador	12
Bear River	16
Buena Vista	12
Camanche Reservoir	12
Carbondale	12
Cooks Station	16
Drytown	12
Electra Power House	12
Fiddletown	12
Ione	12
Jackson	12
Martell	12
Pardee Reservoir	12
Pine Grove	12
Pioneer	16
Plasse	16
Plymouth	12
River Pines	12
Salt Springs Reservoir	16
Silver Lake	16
Sutter Creek	12
Tiger Creek Power House	12
Volcano	12
Butte County (Zones 11, 16)	
Bangor	11
Berry Creek	11
Big Bend	16
Biggs	11
Brush Creek	16
Butte Meadows	16
Centerville Power House	11
Cherokee	11
Chico	11
Clipper Mills	16
Cohasset	11
Dayton	11
De Sabla	11
Durham	11
East Biggs	11
Feather Falls	16
Feather River (Middle Fork)	16
Feather River (North Fork)	16
Forbestown	16
Forest Ranch	11
Gridley	11
Honcut	11
Inskip	16
Jonesville	16
Lake Oroville	11
Lake Wyandotte	11
Las Plumas	11
Lomo	16
Magalia	11
Nelson	11
Nord	11
Oroville	11
Oroville East	11
Palermo	11
Paradise	11
Pentz	11
Pulga	16
Richardson Springs	11
Richvale	11
South Oroville	11
Stirling City	16
Thermalito	11
Thermalito Afterbay	11
Thermalito Forebay	11
Tiger Creek Power House	11
Wyandotte	11
Calaveras County (Zones 12, 16)	
Altaville	12
Angels Camp	12
Arnold	16
Burson	12
Camanche Reservoir	12
Calaveritas	12
Camp Pardee	12
Campo Seco	12
Copperopolis	12
Dorrington	16
Fourth Crossing	12
Ganns	16
Glencoe	12
Hathaway Pines	16
Jenny Lind	12
Melones Reservoir	12
Milton	12
Mokelumne Hill	12

City	CZ
Mountain Ranch	12
Murphys	12
New Hogan Reservoir	12
Paloma	12
Pardee Reservoir	12
Rail Road Flat	12
Salt Springs Reservoir	16
Salt Springs Valley	12
San Andreas	12
Sheep Ranch	12
Stanislaus	16
Vallecito	12
Valley Springs	12
Wallace	12
West Point	12
Wilseyville	12
Colusa County (Zone 11)	
Arbuckle	11
College City	11
Colusa	11
Colusa Trough	11
Delevan	11
East Park Reservoir	11
Fouts Springs	11
Glenn Colusa Canal	11
Grimes	11
Leesville	11
Lodoga	11
Maxwell	11
Princeton	11
Sites	11
Stonyford	11
Sycamore	11
Wilbur Springs	11
Williams	11
Contra Costa County (Zones 3, 12)	
Alamo	12
Antioch	12
Bethel Island	12
Blackhawk	12
Brentwood	12
Briones Reservoir	12
Byron	12
Clayton	12
Concord	12
Crockett	12
Danville	12
Diablo	12
Discovery Bay	12
El Cerrito	3
El Sobrante	3
Hercules	3
Knightsen	12

City	CZ
Lafayette	12
Martinez	12
Moraga	12
Mount Diablo	12
Oakley	12
Old River	12
Orinda	12
Pacheco	12
Pinole	3
Pittsburg	12
Pleasant Hill	12
Port Chicago	12
Richmond	3
Rodeo	3
Saint Mary's College	12
San Pablo	3
San Ramon	12
Suisun Bay	12
Tassajara	2
U.S.N. Weapons Station,	12
Vine Hill	3
Walnut Creek	12
West Pittsburg	12
Del Norte County (Zones 1, 16)	
Crescent City	1
Elk Valley	16
Fort Dick	1
Gasquet	16
Gordon Mountain	16
Hiouchi	1
Horse Flat	16
Idlewild	1
Klamath	1
Klamath Glen	1
Lake Earl	1
Patrick Creek	16
Point Saint George	1
Red Mountain	16
Requa	1
Siskiyou Mountains	16
Smith River	1
Smith River (Middle Fork)	16
Smith River (North Fork)	16
Smith River (South Fork)	16
El Dorado County (Zones 12, 16)	
American River (Silver	16
Aukum	12
Bijou	16
Cameron Park	12
Camino	12
Camp Richardson	16
Clarksville	12
Coloma	12

City	CZ
Cool	12
Diamond Springs	12
Echo Lake	16
Echo Summit	16
El Dorado	12
El Dorado Hills	12
Fallen Leaf Lake	16
Freel Peak	16
Garden Valley	12
Georgetown	12
Greenwood	12
Grizzly Flat	16
Kelsey	12
Kyburz	16
Lake Tahoe	16
Latrobe	12
Loon Lake Reservoir	16
Lotus	12
Meeks Bay	16
Meyers	16
Omo Ranch	16
Outingdale	12
Pacific	16
Pilot Hill	12
Placerville	12
Pollock Pines	16
Rescue	12
Rubicon River	16
Saddle Mountain	16
Shingle Springs	12
Smithflat	12
Somerset	12
South Lake Tahoe	16
Twin Bridges	16
Union Valley Reservoir	16
Vade	16
Volcanoville	16
Fresno County (Zones 13, 16)	
Academy	13
Arroyo Hondo	13
Auberry	13
Big Creek	16
Biola	13
Black Mountain	13
Bonadella Ranchos –	13
Bowles	13
Burrelield	13
Calflax	13
Calwa	13
Caruthers	13
Cedar Grove	16
Centerville	13
Clovis	13
Coalinga	13

City	CZ
Conejo	13
Courtright Reservoir	16
Del Rey	13
Dinkey Creek	16
Dunlap	13
Easton	13
Figarden	13
Firebaugh	13
Five Points	13
Florence Lake	16
Fowler	13
Fresno	13
Fresno Slough	13
Friant	13
Helm	13
Herndon	13
Highway City	13
Hume	16
Humphreys Station	13
Huntington Lake	16
Huron	13
Ivesta	13
Jamesan	13
Kalser Peak	16
Kerman	13
Kings River	13
Kings River (Middle Fork)	16
Kings River (North Fork)	16
Kings River (South Fork)	16
Kingsburg	13
Lakeshore	16
Lanare	13
Laton	13
Little Panoche	13
Mammoth Pool Reservoir	16
Malaga	13
Meadow Lakes	16
Mendota	13
Millerton Lake	13
Miramonte	13
Monmouth	13
Mono Hot Springs	16
Mount Darwin	16
Mount Pinchot	16
Navelencia	13
New Auberry	13
Oilfields	13
Orange Cove	13
Oro Loma	13
Oxalis	13
Parlier	13
Piedra PO	13
Pine Canyon	13
Pine Ridge	16
Pinedale	13
Pinehurst	16
Prather	13
Raisin City	13
Reedley	13
Riverdale	13
Roaring River	16
Rolinda	13
San Joaquin	13
Sanger	13
Selma	13
Shaver Lake	16
Silver Creek	13
Spanish Mountain	16
Squaw Valley	13
Thomas A. Edison Lake	16
Three Rocks	13
Tollhouse	13
Tranquillity	13
Trimmer	16
Turk	13
Vermilion Valley Dam	16
Westhaven	13
Wishin Reservoir	16
Glenn County (Zones 11, 16)	
Artois	11
Bayliss	11
Black Butte	16
Black Butte Reservoir	11
Butte City	11
Chrome	11
Codora	11
Elk Creek	11
Fruto	11
Glenn	11
Greenwood	11
Hamilton City	11
High Peak	11
Logandale	11
Newville	11
Ordbend	11
Orland	11
Stony Gorge Reservoir	11
Willows	11
Humboldt County (Zones 1, 2, 16)	
Alderpoint	2
Alton	1
Arcata	1
Arcata Bay	1
Bayside	1
Bear Buttes	2
Bear River	1
Benbow	2
Big Lagoon	1
Blocksburg	2
Blue Lake	1
Briceland	2
Bridgeville	2
Bull Creek	1
Butler Valley	1
Cape Mendocino	1
Capetown	1
Carlotta	1
Centerville	1
Crannell	1
Cutten	1
Dinsmores	2
Eel Rock	2
Elk River	1
Elk River (North Fork)	1
Elk River (South Fork)	1
Ettersburg	1
Eureka	1
Falk	1
Fernbridge	1
Ferndale	1
Fieldbrook	1
Fields Landing	1
Fort Seward	2
Fortuna	1
Freshwater	1
Garberville	2
Harris	2
Holmes	1
Honeydew	1
Hoopa	2
Humboldt Bay	1
Hupa Mountain	1
Hydesville	1
Johnsons	1
King Range	1
Kneeland	1
Korbel	1
Little River	1
Loleta	1
Mail Ridge	2
Maple Creek	1
Mattole River	1
Mattole River (North Fork)	1
Mattole River (South Fork)	1
McCann	2
McKinleyville	1
Miranda	2
Mount Lassic	2
Myers Flat	2
Orick	1
Orleans	2
Patricks Point	1
Pepperwood	1

City	CZ
Petrolia	1
Phillipsville	2
Point Delgada	1
Redcrest	1
Redway	2
Richardson Grove	2
Rio Dell	1
Rohnerville	1
Salmon Mountain	16
Salt River	1
Samoa	1
Scotia	1
Sequoia	2
Shelter Cove	1
Shively	1
South Fork	1
Taylor Peak	1
Trinidad	1
Trinidad Head	1
Waddington	1
Weitchpec	2
Weott	1
Westhaven	1
Whitehorn	1
Willlow Creek	2
Imperial County (Zones 14, 15)	
Acolita	15
Alamo River	15
Amos	15
Andrade	15
Araz Wash	15
Arroyo Salada	15
Bard	15
Bombay Beach	15
Bonds Corner	15
Brawley	15
Calexico	15
Calipatria	15
Carrizo Wash	15
Clyde	15
Coyote Wash	15
Desert Shores	15
Dixieland	15
East Mesa	15
El Centro	15
Ferguson Lake	15
Frink	15
Glamis	15
Gold Rock Rch	15
Gordons Well	15
Heber	15
Holtville	15
Imperial	15
Imperial Dam	15

City	CZ
Imperial Reservoir	15
Imperial Valley	15
Iris	15
Laguna Dam	15
Mammoth Wash	15
Midwell Well	14
Mount Signal	15
Mountain Spring	15
Niland	15
Ocotillo	15
Ogilby	15
Orita	15
Palm Wash	15
Palo Verde	15
Picacho	15
Picacho Wash	15
Pinto Wash	15
Plaster City	15
Quartz Peak	15
Salton City	15
Salton Sea	15
Sand Hills	15
Sandia	15
Seeley	15
Senator Wash	15
Superstition Mountain	15
Tule Wash	15
U.S.N. Air Field, El Centro	15
Unnamed Wash	15
Vinagre Wash	15
West Mesa	15
Westmorland	15
Wiest	15
Winterhaven	15
Wister	15
Yuha Desert	15
Inyo County (Zones 14, 16)	
Airport Lake	14
Amargosa Range	14
Amargosa River	14
Argus Peak	16
Argus Range	16
Ballarat	14
Bartlett	16
Bennetts Well	14
Big Pine	16
Bishop	16
Cartago	16
Cerro Gordo Peak	16
Chloride City	16
Coso Hot Springs	16
Coso Junction	16
Coso Peak	16
Coso Range	16

City	CZ
Cottonwood Canyon	14/16
Cottonwood Mountains	16
Darwin	16
Darwin Wash	16
Death Valley	14
Death Valley Junction	14
Death Valley Wash	14
Deep Springs	16
Deep Springs Lake	16
Dolomite	16
Dunmovin	16
Echo Canyon	14
Emigrant Canyon	16
Eureka Valley	16
Fish Springs	16
Franklin Well	14
Funeral Park	14
Furnace Creek Wash	14
Glacier	16
Greenwater Range	14
Haiwee Reservoir	16
Independence	16
Inyo Mountains	16
Kearsarge	16
Keeler	16
Keough Hot Springs	16
Last Chance Range	16
Laws	16
Lee Wash	16
Little Lake	16
Loco	16
Lone Pine	16
Lostman Spring	16
Manley Peak	16
Marble Canyon	16
Midway Well	14
Miller Spring	14
Mount Darwin	16
Mount Morgan	16
Mount Whitney	16
Nopah Range	14
Olancha	16
Olancha Peak	16
Owens Lake	16
Owens River	16
Owens Valley	16
Owenyo	16
Owlshead Mountains	14
Pahrump Valley	14
Paiute Canyon	16
Panamint	16
Panamint Range	16
Panamint Springs	14
Panamint Valley	14
Pleasant Grove	16

City	CZ
Red Wall Canyon	16
Renegade Canyon	16
Rhodes Wash	14
Rovana	16
Ryan	14
Saline Valley	16
Salt Lake	16
Sawtooth Peak	16
Scheelite	16
Scottys Castle	16
Sheep Canyon	14
Shoshone	14
Skidoo	16
Slate Range	14
Sourdough Spring	16
Spanish Spring	16
Stovepipe Wells	14
Teakettle Junction	16
Tecopa	14
Telescope Peak	16
Tinemaha Reservoir	16
Titus Canyon	16
Valley Wells	14
Waucoba Mountain	16
Waucoba Wash	16
White Mountains	16
Wildrose RS	16
Willow Creek Camp	16
Wingate Wash	14
Kern County (Zones 13, 14, 16)	
Actis	14
Adobe	13
Alta Sierra	16
Antelope Plain	13
Arvin	13
Bakersfield	13
Bissell	14
Blackwells Corner	13
Bodfish	16
Boron	14
Breckenridge Mountain	16
Brown	14
Buckhorn Lake	14
Buena Vista Lake Bed	13
Buttonwillow	13
Calders Corner	13
Caliente	16
California City	14
Cantil	14
China Lake	14
Claraville	16
Conner	13
Cuddy Canyon	16
Delano	13
Derby Acres	13
Devils Den	13
Di Giorgio	13
Edison	13
Edwards Air Force Base	14
El Paso Mountains	14
Famoso	13
Fellows	13
Ford City	13
Frazier Park	16
Freeman Junction	14
Fremont Valley	14
Garlock	14
Glennville	16
Gold Canyon	16
Golden Hills	16
Grapevine	13
Greenacres	13
Greenfield	13
Greenhorn Mountains	16
Havilah	16
Hillcrest Center	16
Indian Wells Valley	14
Inyokern	14
Isabella Reservoir	16
Jasmin	13
Johannesburg	14
Kecks Corner	13
Keene	16
Kern River (South Fork)	16
Kernville	16
Koehn Lake	14
Lake Isabella	16
Lakeview	13
Lamont	13
Last Chance Canyon	14
Lebec	16
Little Dixie Wash	14
Lone Tree Canyon	16
Loraine	16
Lost Hills	13
Maricopa	13
McFarland	13
McKittrick	13
Mettler	13
Miracle Hot Springs	16
Mojave	14
Monolith	16
Neuralia	14
North Edwards	14
Oildale	13
Old River	13
Onyx	16
Orchard Peak	13
Pond	13
Rag Gulch	13
Randsburg	14
Ridgecrest	14
Rogers Lake	14
Rosamond	14
Rosamond Lake	14
Saltdale	14
Searles	14
Shafter	13
Stevens	13
Taft	13
Taft Heights	13
Tehachapi	16
Tehachapi Mountains	16
Tehachapi Pass	16
Tupman	13
Walker Pass	16
Wasco	13
Weed Patch	13
Weldon	16
Wheeler Ridge	13
Willow Springs	14
Wofford Heights	16
Woody	13
Kings County (Zone 13)	
Armona	13
Avenal	13
Corcoran	13
Corcoran Reservoir	13
Grangeville	13
Guernsey	13
Hanford	13
Hardwick	13
Kern River Channel	13
Kettleman City	13
Kettleman Hills	13
Kings River	13
Lemoore	13
Stratford	13
Tulare Lake Bed	13
Tule River	13
U.S.N. Air Station,	13
Lake County (Zone 2)	
Barkerville	2
Bartlett Springs	2
Clearlake	2
Clearlake Highlands	2
Clearlake Oaks	2
Clearlake Park	2
Cobb	2
Finley	2
Glenhaven	2
Hobergs	2

City	CZ
Kelseyville	2
Lake Pillsbury	2
Lakeport	2
Lower Lake	2
Lucerne	2
Mayacmas Mountains	2
Middletown	2
Mount Konocti	2
Nice	2
Upper Lake	2
Lassen County (Zone 16)	
Beckwourth Pass	16
Bieber	16
Big Valley Mountains	16
Buntingville	16
Calneva	16
Clear Creek	16
Constantia	16
Crater Mountain	16
Diamond Mountains	16
Doyle	16
Eagle Lake	16
Eagle Lake Resort	16
Fleming Fish & Game	16
Fredonyer Peak	16
Goumaz	16
Halls Flat	16
Hayden Hill	16
Herlong	16
Honey Lake	16
Horse Lake	16
Janesville	16
Jellico	16
Johnstonville	16
Karlo	16
Leavitt	16
Litchfield	16
Little Valley	16
Lodgepole	16
Madeline	16
Madeline Plains	16
Mason Station	16
McDonald Peak	16
Milford	16
Moon Lake	16
Mountain Meadows	16
Norvell	16
Nubieber	16
Observation Peak	16
Pit River (town)	16
Plumas	16
Ravendale	16
Sage Hen	16
Scotts	16
Sierra Army Depot	16
Skedaddle Mountains	16
Stacy	16
Standish	16
Susan River	16
Susanville	16
Termo	16
Tule Mountain	16
Viewland	16
Wendel	16
Westwood	16
Los Angeles County (Zones 6, 8, 9, 14, 16)	
Acton	14
Agoura Hills	9
Agua Duice	9
Alhambra	9
Aliso Canyon	16
Alondra Park	6
Altadena	9
Antelope Center	14
Antelope Valley	14
Arcadia	9
Artesia	8
Avalon	6
Avocado Heights	16
Azusa	9
Baldwin Park	9
Bassett	9
Bell	8
Bell Gardens	8
Bellflower	8
Beverly Hills	9
Big Pines	16
Big Rock Wash	14
Big Tujungs Canyon	16
Bradbury	9
Burbank	9
Calabasas	9
Canoga Park	9
Carson	6
Castaic	9
Caswell	16
Cerritos	8
Charter Oak	9
Chatsworth	9
City Terrace	9
Claremont	9
Commerce	8
Compton	8
Cornell	6
Covina	9
Cudahy	8
Culver City	8
Del Aire	6
Desert View Highland	14
Devils Canyon	16
Diamond Bar	9
Dominguez	8
Downey	8
Duarte	9
East Compton	8
East La Mirada	9
East Los Angeles	9
East Pasadena	16
East San Gabriel	9
East Whittier	9
El Monte	9
El Segundo	6
Elizabeth Lake Canyon	16
Encino	9
Fairmont	14
Florence	8
Gardena	8
Glendale	9
Glendora	9
Gorman	16
Granada Hills	9
Green Valley	16
Hacienda Heights	9
Harbor City	8
Hawaiian Gardens	8
Hawthorne	8
Hermosa Beach	6
Hi Vista	14
Hidden Hills	9
Hidden Springs	16
Highland Park	9
Hollywood	9
Huntington Park	8
Industry	9
Inglewood	8
Irwindale	9
Juniper Hills	14
La Canada Flintridge	9
La Crescenta	9
La Habra Heights	9
La Mirada	9
La Puente	9
La Verne	9
Ladera Heights	9
Lake Los Angeles	14
Lakewood	8
Lancaster	14
Lawndale	8
Lennox	8
Leona Valley	14
Little Rock Wash	4
Littlerock	14

City	CZ
Llano	14
Lomita	6
Long Beach	6/8
Los Angeles	8/9
Los Nietos	9
Lynwood	8
Malibu	6
Manhattan Beach	6
Marina del Rey	9
Maywood	8
Mira Canyon	9
Monrovia	9
Monte Nido	6
Montebello	9
Monterey Park	9
Montrose	9
Mount San Antonio	16
Mount Wilson	16
Newhall	9
North Hollywood	9
Northridge	9
Norwalk	8
Pacific Palisades	6
Pacoima	16
Pacoima Canyon	16
Palmdale AP	14
Palos Verdes Estates	6
Panorama City	9
Paramount	8
Pasadena	9
Pearblossom	14
Pearland	14
Pico Rivera	9
Point Dume	6
Point Fermin	6
Pomona	9
Pyramid Lake	16
Quartz Hill	14
Rancho Palos Verdes	6
Redman	14
Redondo Beach	6
Reseda	9
Rolling Hills	6
Rolling Hills Estates	6
Rosamond Lake	14
Rosemead	9
Rowland Heights	9
San Antonio Canyon	16
San Clemente Island	6
San Dimas	9
San Fernando	9
San Fernando Valley	9
San Gabriel	9
San Gabriel Mountains	16
San Gabriel River (West	16
San Marino	9
San Pedro	6
San Pedro Bay	6
Sandberg	16
Santa Catalina Island	6
Santa Clarita	9
Santa Fe Springs	9
Santa Monica	6
Santa Monica Bay	6
Santa Monica Mountains	6
Saugus	6
Sepulveda	9
Sepulveda Dam	9
Sherman Oaks	9
Sierra Madre	9
Signal Hill	6
Sleepy Valley	9
Solemint	9
South El Monte	9
South Gate	8
South Pasadena	9
South San Gabriel	9
South Whittier	9
Studio City	9
Sun Valley	9
Sunland	9
Sylmar	9
Tarzana	6
Tejon Pass	16
Tejon Rancho	16
Temple City	9
Three Points	14
Topanga	6
Topanga Beach	6
Topanga Canyon	6
Torrance	6
Tujunga	9
U.S.N. Facility, San	6
U.S.N. Shipyard, Long	6
UCLA	9
Val Verde Park	9
Valencia	9
Valinda	9
Valyermo	14
Van Nuys	9
Venice	6
Verdugo Mountains	9
Vernon	8
View Park	9
Vincent	14
Walnut	9
Walnut Park	8
West Athens	8
West Carson	6
West Compton	8
West Covina	9
West Hollywood	9
West Puente Valley	9
West Whittier-Los Nietos	9
Westlake Village	9
Westmont	8
Whittier	9
Whittier Narrows Dam	9
Willow Brook	8
Willowbrook	8
Wilsona Gardens	14
Woodland Hills	9
Zuma Canyon	6
Madera County (Zones 13, 16)	
Ahwahnee	13
Bass Lake	16
Berenda	13
Bonita	13
Chowchilla	13
Chowchilla Canal	13
Coarsegold	13
Dairyland	13
Daulton	13
Fairmead	13
Friant Dam	13
Kismet	13
Knowles	13
La Vina	13
Madera	13
Madera Acres	13
Madera Canal	13
Mammoth Pool Reservoir	16
Millerton Lake	13
Mount Lyell	16
North Fork	16
Oakhurst	13
O'Neals	13
Raymond	13
Red Top	13
Ripperdan	13
San Joaquin River (East	16
San Joaquin River (Middle	16
San Joaquin River (North	16
San Joaquin River (South	16
San Joaquin River (West	16
Sierra Nevada	16
Trigo	13
Wishin	16
Marin County (Zones 2, 3)	
Abbotts Lagoon	3
Angel Island	3
Belvedere	3
Black Point	2

City	CZ
Bodega Bay	3
Bolinas	3
Burdell	2
Corte Madera	2
Dillon Beach	3
Drakes Bay	3
Drakes Estero	3
Fairfax	2
Fallon	3
Forest Knolls	2
Fort Baker	3
Golden Gate	3
Gulf of the Farallones	3
Hamilton A.F.B.	2
Inverness	3
Kentfield	2
Larkspur	2
Marin City	3
Marshall	3
Mill Valley	3
Nicasio	2
Novato	2
Olema	3
Petaluma River	2
Point Bonita	3
Point Reyes	3
Point Reyes Station	3
Ross	2
San Anselmo	2
San Quentin	2
San Rafael	2
Santa Venetia	2
Sausalito	3
Stinson Beach	3
Tamalpais-Homestead	3
Tiburon	3
Tomales	3
Tomales Bay	3
Woodacre	2
Mariposa County (Zone 12, 16)	
Bagby	12
Bear Valley	12
Ben Hur	12
Bootjack	12
Briceburg	12
Buck Meadows	16
Catheys Valley	12
Coulterville	12
Darrah	12
Dudleys	12
El Portal	16
Fish Camp	16
Half Dome	16
Hornitos	12
Lake McClure	12
Mariposa	12
Merced River (South Fork)	16
Midpines	16
Mormon Bar	12
Mount Bullion	12
New Exchequer Dam	12
Pilot Peak	16
Usona	13
Wawona	16
Yosemite Valley	16
Yosemite Village	16
Mendocino County (Zones 1, 2,16)	
Albion	1
Anchor Bay	1
Arnold	2
Bell Springs	2
Black Butte River	16
Boonville	2
Branscomb	1
Bruhel Point	1
Burbeck	2
Cahto Peak	2
Calpella	2
Caspar	1
Cleone	1
Comptche	1
Covelo	2
Cummings	2
Dos Rios	2
Echo	2
Elk	1
Etsel Ridge	16
Fort Bragg	1
Gualala	1
Gualala River (South Fork)	1
Hales Grove	1
Hearst	2
Hopland	2
Inglenook	1
Lake Mendocino	2
Leech Lake Mountain	16
Leggett	1
Little River	1
Longvale	2
Manchester	1
Mendocino	1
Mina	2
Nashmead	2
Navarro	2
Northspur	2
Philo	2
Piercy	2
Pieta	2
Point Arena	1
Potter Valley	2
Ranch	1
Redwood Valley	2
Reynolds	2
Ridge	2
Rockport	1
Sanel Mountain	2
Spyrock	2
Talmage	2
Tatu	2
Ukiah	2
Westport	1
Williams Peak	2
Willits	2
Woodman	2
Yorkville	2
Merced County (Zone 12)	
Athlone	12
Atwater	12
Ballico	12
Castle Air Force Base	12
Cressey	12
Delhi	12
Dos Palos	12
El Nido	12
Gustine	12
Hilmar	12
Hopeton	12
Ingomar	12
Irwin	12
Le Grand	12
Livingston	12
Los Banos	12
Los Banos Reservoir	12
Merced	12
Merced Falls	12
Merced River	12
O'Neill Forebay	12
Plainsburg	12
Planada	12
San Luis Holding Reservoir	12
Santa Rita Park	12
Snelling	12
South Dos Palos	12
Stevinson	12
Tuttle	12
Volta	12
Winton	12
Modoc County (Zone 16)	
Adin	16
Alturas	16
Ambrose	16

City	CZ
Bayley	16
Big Sage Reservoir	16
Big Valley Mountains	16
Canby	16
Carr Butte	16
Cedarville	16
Clear Lake Reservoir	16
Cornell	16
Cow Head Lake	16
Dalton	16
Davis Creek	16
Day	16
Eagle Peak	16
Eagleville	16
Fandango Pass	16
Fletcher	16
Fort Bidwill	16
Goose Lake	16
Grouse Mountain	16
Hackamore	16
Hollenbeck	16
Jess Valley	16
Kandra	16
Kephart	16
Lake City	16
Lava Beds	16
Likely	16
Lookout	16
Lookout Junction	16
Lost River	16
Lower Lake	16
Mammoth	16
McArthur	16
Meares	16
Middle Alkali Lake	16
Mount Vida	16
Newell	16
Perez	16
Pit River (North Fork)	16
Pit River (South Fork)	16
Raker & Thomas Reservoir	16
Scarface	16
Surprise Valley	16
Tionesta	16
Upper Lake	16
Warner Mountains	16
White Horse	16
Whitehorse Flat Reservoir	16
Willow Ranch	16
Mono County (Zone 16)	
Benton	16
Benton Hot Springs	16
Bodie	16
Bridgeport	16
Bridgeport Reservoir	16
Chalfant	16
Chidago Canyon	16
Coleville	16
Cowtrack Mountain	16
Crestview	16
East Walker River	16
Fales Hot Springs	16
Glass Mountain	16
Grant Lake	16
June Lake	16
Lake Crowley	16
Leavitt Peak	16
Lee Vining	16
Little Walker River	16
Mammoth Lakes	16
Matterhorn Peak	16
McGee Canyon	16
Mono Lake	16
Mount Lyell	16
Mount Patterson	16
Oasis	16
River Springs Lakes	16
Sonora Pass	16
Tioga Pass	16
Toms Place	16
Topaz	16
Topaz Lake	16
Twin Lakes	16
West Walker River	16
White Mountains	16
White Mountain Peak	16
Monterey County (Zone 3, 4)	
Alisal	3
Alisal Slough	3
Aromas	3
Arroyo Seco	4
Big Sur	4
Big Sur River (North Fork)	4
Bolsa Knolls	3
Bradley	4
Bryson	4
Camp Roberts	4
Cape San Martin	4
Carmel Highlands	3
Carmel Valley	3
Carmel-by-the-Sea	3
Castroville	3
Cholame Hills	4
Chualar	3
Coburn	4
Del Rey Oaks	3
Elkhorn Slough	3
Fort Ord	3
Gonzales	3
Gorda	3
Greenfield	4
Jamesburg	4
Jolon	4
Junipero Serra Peak	4
King City	4
Lockwood	4
Lonoak	4
Lucia	3
Marina	3
Metz	4
Monterey	3
Monterey Bay	3
Moss Landing	3
Mount Carmel	4
Notleys Landing	3
Pacific Grove	3
Paraiso Springs	4
Parkfield	4
Pebble Beach	3
Pine Canyon	4
Point Lobos	3
Point Sur	3
Posts	3
Powell Canyon	4
Priest Valley	4
Prunedale	3
Reliz Canyon	4
Salinas	3
San Antonio Mission	4
San Antonio Reservoir	4
San Antonio River	4
San Antonio River (North	4
San Ardo	4
San Lucas	4
Sand City	3
Sargent Canyon	4
Seaside	3
Soledad	3
Spence	3
Spreckels	3
Tassajara Hot Springs	4
Thompson Canyon	4
U.S.N. Facility, Point Sur	3
Vineyard Canyon	4
Wunpost	4
Napa County (Zone 2, 12)	
American Canyon	2
Angwin	2
Berryessa Lake	2
Berryessa Peak	2/12
Calistoga	2
Duttons Landing	2
Knoxville	2

City	CZ
Lake Berryessa	2
Lake Henessey	2
Markley Cove	2
Mount Saint Helena	2
Napa	2
Napa Junction	2
Oakville	2
Pope Valley	2
Rutherford	2
Saint Helena	2
Sanitarium	2
Yountville	2
Nevada County (Zone 11, 16)	
Boca	16
Boca Reservoir	16
Cedar Ridge	11
Chicago Park	11
Deer Creek Power House	16
Donner Pass	16
Floriston	16
French Corral	11
Graniteville	16
Grass Valley	11
Higgins Corner	11
Hobart Mills	16
Jackson Meadows	16
La Barr	11
Lake Spaulding	16
Middle Yuba River	16
Nevada City	11
Norden	16
North Bloomfield	16
North Columbia	11
North San Juan	11
Penn Valley	11
Pilot Peak	11
Rough and Ready	11
Soda Springs	16
Truckee	16
Truckee River	16
Washington	16
Orange County (Zone 6, 8)	
Aliso Viejo	8
Anaheim	8
Brea	8
Buena Park	8
Capistrano Beach	6
Corona Del Mar	6
Costa Mesa	6
Coto De Caza	8
Cypress	8
Dana Point	6
East Irvine	8
El Toro	8
Emerald Bay	6
Fountain Valley	6
Fullerton	8
Garden Grove	8
Huntington Beach	6
Irvine	8
John Wayne AP	6
La Habra	9
La Palma	8
Laguna Beach	6
Laguna Hills	6/8
Laguna Niguel	6
Lake Forest	8
Los Alamitos	8
Mission Viejo	8
Modjeska	8
Newport Bay	6
Newport Beach	6
Orange	8
Placentia	8
Rancho Santa Margarita	8
Rossmoor	8
San Clemente	6
San Juan Capistrano	6
Santa Ana	8
Santiago Reservoir	8
Seal Beach	6
Silverado	8
South Laguna	6
Stanton	8
Sunset Beach	6
Surfside	6
Trabuco Canyon	8
Tustin	8
Tustin Foothills	8
U.S.M.C. Air Station, El	8
U.S.N. Air Station, Los	8
U.S.N. Weapons Station,	6
Villa Park	8
Westminster	6
Yorba Linda	8
Placer County (Zones 11, 16)	
Alta	16
Applegate	11
Auburn	11
Baxter	16
Blue Canyon	16
Bowman	11
Carnelian Bay	16
Cisco	16
Clipper Gap	11
Colfax	11
Donner Pass	16
Duncan Canyon	16
Dutch Flat	16
Eder	16
Elders Corner	11
Emigrant Gap	16
Forest Hill Divide	16
Foresthill	16
Gold Run	16
Granite Bay	11
Granite Chief	16
Hidden Valley	11
Homewood	16
Iowa Hill	16
Kings Beach	16
L.L. Anderson Reservoir	16
Lake Tahoe	16
Lincoln	11
Loomis	11
Meadow Vista	11
Michigan Bluff	16
Newcastle	11
North Auburn	11
Penryn	11
Rocklin	11
Roseville	11
Rubicon River	16
Sheridan	11
Squaw Valley (Olympic	16
Tahoe City	16
Tahoe Pines	16
Tahoe Vista	16
Tahoma	16
Troy	16
Weimar	11
Whitney	11
Plumas County (Zone 16)	
Almanor	16
Antelope Lake	16
Bald Eagle Mountain	16
Beckwourth	16
Beckwourth Pass	16
Belden	16
Blairsden	16
Bucks Lake	16
Canyondam	16
Caribou	16
Chester	16
Chilcoot	16
Clio	16
Crescent Mills	16
Cromberg	16
Delleker	16
Diamond Mountains	16
Dixie Mountain	16

City	CZ
Drakesbad	16
East Quincy	16
Frenchman Lake	16
Genesee	16
Greenville	16
Johnsville	16
Keddie	16
Keddie Ridge	16
La Porte	16
Lake Almanor	16
Lake Davis	16
Little Grass Valley	16
Massack	16
Meadow Valley	16
Moccasin	16
Paxton	16
Pilot Peak	16
Portola	16
Quincy	16
Seneca	16
Sierra Valley	16
Sloat	16
Spring Garden	16
Storrie	16
Taylorsville	16
Turntable Creek	16
Twain	16
Vinton	16

Riverside County (Zone 10, 14, 15, 16)

Aguanga	10
Alberhill	10
Anza	16
Arlington	10
Banning	15
Beaumont	10
Big Maria Mountains	15
Blythe	15
Box Canyon	15
Cabazon	15
Cahuilla	16
Calimesa	10
Canyon Lake	10
Cathedral City	15
Cherry Valley	10
Chiriaco Summit	14
Chuckwalla Mountains	14
Chuckwalla Valley	15
Coachella	15
Coachella Valley	15
Corona	10
Deep Canyon	15
Desert Beach	15
Desert Center	15
Desert Hot Springs	15
Durmid	15
Eagle Mountain	14
Eagle Mountains	14
East Hemet	10
Edgemont	10
Elsinore	10
Ford Dry Lake	15
Fried Liver Wash	14
Gillman Hot Springs	10
Glen Avon	10
Hayfield	14
Hayfield Lake	14
Hemet	10
Highgrove	10
Home Gardens	10
Homeland	10
Idyllwild	16
Inca	15
Indian Wells	15
Indio	15
La Quinta	15
Lake Elsinore	10
Lake Mathews	10
Lake Perris	10
Lakeland Village	10
Lakeview	10
March A.F.B.	10
Martinez Canyon	15
McCoy Wash	15
Mecca	15
Mesaville	15
Midland	15
Mira Loma	10
Moreno Valley	10
Mount Center	16
Mount San Jacinto	16
Murrieta	10
Nicholls Warm Springs	15
Nightingale	16
Norco	10
North Palm Springs	15
Nuevo	10
Oasis	15
Palen Lake	15
Palen Mountains	15
Palm Canyon	15
Palm Desert	15
Palm Desert Country	15
Palm Springs	15
Palo Verde Valley	15
Pedley	10
Perris	10
Pinkham Wash	15
Pinto Mountains	14
Pinto Wash	14
Porcupine Wash	14
Prado Flood Control Basin	10
Quail Valley	10
Railroad Canyon Reservoir	10
Rancho Mirage	15
Rice Valley	15
Ripley	15
Riverside	10
Romoland	10
Rubidoux	10
Salton Sea	15
Sage	10
San Gorgonio Pass	15
San Gorgonio River	15
San Jacinto	10
San Jacinto Mountains	15
San Jacinto River	10
San Timoteo Canyon	10
Santa Rosa Mountains	15
Smoke Tree Wash	14
Sun City	10
Sunnymead	10
Temecula	10
Temescal Wash	10
Thermal	15
Thomas Mountain	16
Thousand Palms	15
Valle Vista	10
White Water	15
Wildomar	10
Winchester	10
Woodcrest	10

Sacramento County (Zone 12)

American River	12
Antelope	12
Arden Town	12
Brannan Island	12
Bridge House	12
Carmichael	12
Citrus Heights	12
Clay	12
Cosumnes River	12
Courtland	12
Del Paso Heights	12
Elk Grove	12
Elverta	12
Fair Oaks	12
Florin	12
Folsom	12
Foothill Farms	12
Franklin	12
Freeport	12

City	CZ
Galt	12
Herald	12
Hood	12
Isleton	12
La Riviera	12
Mather Air Force Base	12
McClellan Air Force Base	12
Nimbus	12
North Highlands	12
North Sacramento	12
Orangevale	12
Parkway-South	12
Point Pleasant	12
Rancho Cordova	12
Rio Linda	12
Robla	12
Rosemont	12
Ryde	12
Sacramento AP	12
Sacramento Army Depot	12
Sheldon	12
Sloughhouse	12
Twin Cities	12
Vorden	12
Walnut Grove	12
White Rock	12
Wilton	12
San Benito County (Zone 4)	
Arroyo Dos Picachos	4
Bitterwater	4
Hollister	4
Idria	4
Llanada	4
Paicines	4
Panoche	4
San Benito	4
San Benito Mountain	4
San Benito River	4
San Juan Bautista	4
Tres Pinos	4
San Bernardino County (Zone 10, 14, 15, 16)	
Adelanto	14
Afton	14
Alta Loma	10
Amboy	15
Apple Valley	14
Argus	14
Arrowhead Junction	14
Atolia	14
Avawatz Mountains	14
Bagdad	15
Baker	14

City	CZ
Balch	14
Barstow	14
Bell Mountain	14
Bell Mountain Wash	14
Big Bear City	16
Big Bear Lake	16
Black Canyon Wash	14
Black Meadow Landing	15
Bloomington	10
Brant	14
Bristol Lake	15
Bristol Mountains	14
Bryman	14
Budweiser Wash	14
Bull Spring Wash	14
Bullion Mountains	14
Cadiz	15
Cadiz Lake	15
Cadiz Valley	15
Cady Mountains	14
Cajon Junction	16
Cajon Summit	16
Calada	14
Camino	14
Camp Angelus	16
Cedar Wash	14
Chambless	15
China Lake	14
Chino	10
Chino Hills	10
Chubbuck	15
Cima	14
Clark Mountain	14
Colorado River	15
Colton	10
Cottonwood Wash	14
Coyote Lake	14
Crestline	16
Cross Roads	15
Crucero	14
Cucamonga	10
Cuddeback Lake	14
Daggett	14
Dale Lake	14
Danby	14
Danby Lake	15
Dawes	14
Del Rosa	16
Desert	14
Devils Playground	14
Devils Playground Wash	14
Devore	10
Eagle Crags	14
Earp	15
East Highlands	10

City	CZ
El Mirage	14
El Mirage Lake	14
Emerson Lake	14
Essex	14
Etiwanda	14
Fawnskin	16
Fenner	14
Fenner Valley	14
Flynn	14
Fontana	10
Forest Falls	16
Fossil Canyon	14
Fremont Peak	14
Fremont Wash	14
George A.F.B.	14
Glasgow	14
Goffs	14
Goldstone	14
Goldstone Lake	14
Grand Terrace	10
Granite Mountains	14
Green Valley Lake	16
Grommet	15
Halloran Springs	14
Harper Lake	14
Hart	14
Havasu Lake	15
Hawes	14
Hector	14
Helendale	14
Hesperia	14
Highland	10
Hinkley	14
Hodge	14
Homer	14
Homer Wash	14
Ivanpah	14
Ivanpah Lake	14
Ivanpah Valley	14
Java	15
Joshua Tree	14
Kelso	14
Kelso Wash	14
Kingston Peak	14
Kingston Wash	14
Klondike	14
Kramer Junction	14
Lake Arrowhead	16
Lake Havasu	15
Landers	14
Lane Mountain	14
Lanfair Valley	14
Lavic	14
Lavic Lake	14
Leach Lake	14

City	CZ
Lenwood	14
Lockhart	14
Loma Linda	10
Los Serranos	10
Lucerne Lake	14
Lucerne Valley	14
Ludlow	14
Lytle Creek	16
Manix	14
Mentone	10
Mesquite Lake	14
Midway	14
Milligan	15
Minneola	14
Mitchell Caverns	14
Mojave River	14
Mojave River Forks	14
Montclair	10
Morongo Valley	14
Mount Baldy	16
Mount San Antonio	16
Mountain Pass	14
Muscoy	10
Needles	15
Newberry Springs	14
Nipton	14
Norton AFB	10
Old Dale	14
Ontario	10
Ord Mountain	14
Oro Grande	14
Oro Grande Wash	14
Owlshead Mountains	14
Palm Wells	14
Parker Dam	15
Phelan	14
Pinnacles NM	14
Pinon Hills	14
Pioneer Point	14
Pioneertown	14
Pipes Wash	14
Piute Valley	14
Piute Wash	14
Prado Flood Control Basin	10
Providence Mountains	14
Rancho Cucamonga	10
Red Mountain	14
Redlands	10
Rialto	10
Rice	15
Riggs Wash	14
Running Springs	16
Saltmarsh	15
Saltus	15
San Bernardino	10
San Bernardino Mountains	16
San Gorgonio Mountain	16
Sands	14
Searles Lake	14
Seven Oaks	16
Shadow Valley	14
Sidewinder Mountain	14
Silver Lake	14
Silverwood Lake	16
Slate Range	14
Soda Lake	14
Soda Mountains	14
Spangler	14
Squirrel Inn	14
Superior Lake	14
Teagle Wash	14
Tiefort Mountains	14
Trona	14
Turtle Mountains	14
Twentynine Palms	14
Upland	10
Victorville	14
Vidal	15
Vidal Junction	15
Vidal Valley	15
Vidal Wash	15
Watson Wash	14
Westend	14
Whipple Mountains	15
Whitewater River (North	16
Whitewater River (South	16
Willow Wash	14
Winston Wash	14
Wrightwood	16
Yermo	14
Yucaipa	10
Yucca Valley	14
San Diego County (Zone 7, 10, 14, 15)	
Agua Caliente Springs	15
Alpine	10
Barona	10
Barrett Dam	10
Barrett Junction	10
Bonsall	10
Borrego	15
Borrego Springs	15
Bostonia	10
Boulevard	14
Cabrillo National	7
Camp Pendleton	10
Campo	14
Cardiff-by-the-Sea	7
Carlsbad	7
Casa de Oro, Mount Helix	10
Chula Vista	7
Coronado	7
Cuyamaca	7
Cuyamaca Peak	14
De Luz	10
Del Dios	10
Del Mar	7
Descanso	14
Dos Cabezas	15
Duguynos Canyon	15
Dulzura	10
El Cajon	10
El Capitan Reservoir	14
Encanto	10
Encinitas	7
Escondido	10
Fallbrook	10
Fernbrook	10
Fort MacArthur	7
Grossmont	7
Guatay	14
Harbinson Canyon	10
Henshaw Dam	10
Imperial Beach	7
Jacumba	14
Jacumba Mountains	15
Jamul	10
Julian	14
La Jolla	7
La Mesa	7
Lake Henshaw	14
Lakeside	10
Las Flores	7
Lemon Grove	7
Leucadia	7
Linda Vista	7
Live Oak Springs	14
Loert Otay Reservoir	10
Lower Bear River	16
Margarita Peak	10
Mesa Grande	14
Miramar Naval Air Station	7
Mission Bay	7
Monument Peak	14
Morena VIllage	14
Mount Laguna	14
National City	7
Oak Grove	14
Ocean Beach	7
Oceanside	7
Ocotillo Wells	15
Otay	7
Pacific Beach	7
Pala	10

City	CZ
Palm City	7
Palomar Mountain	14
Pauma Valley	10
Pendleton M.C.B.	7
Pine Valley	14
Point La Jolla	7
Point Loma	7
Potrero	14
Poway Valley	10
Rainbow	10
Ramona	10
Ranchita	14
Rancho Bernardo	10
Rancho San Diego	10
Rancho Santa Fe	7
San Diego	7/10
San Diego Bay	7
San Diego Naval Hospital	7
San Diego Naval Station	7
San Felipe	14
San Luis Rey	7
San Luis Rey River (West	14
San Marcos	10
San Mateo Canyon	10
San Onofre	7
San Onofre Canyon	10
San Pasqual	10
San Vicente Reservoir	10
San Ysidro	7
San Ysidro Mountains	10
Santa Ysabel	14
Santee	10
Solana Beach	7
Spring Valley	10
Suncrest	10
Sweetwater Reservoir	10
Tecate	14
Tierra del Sol	14
Tijuana River	7
U.S. Navy Training Center	7
U.S.M.C. Recruit Depot,	7
U.S.N. Air Station, Imperial	7
U.S.N. Air Station, North	7
U.S.N. Reservation, Point	7
Valley Center	10
Vista	7
Warner Springs	14
Wynola	14
San Francisco County (Zone 1, 3)	
Farallon Island	1
Golden Gate	3
Gulf of the Farallones	3
Presidio of San Francisco	3
San Francisco	3
San Francisco Bay	3
Treasure Island Naval	3
San Joaquin County (Zone 12)	
Acampo	12
Banta	12
Bellota	12
Bethany	12
Calaveras River	12
Carbona	12
Clements	12
Collegeville	12
Collierville	12
Corral Hollow	12
Country Club	12
Escalon	12
Farmington	12
French Camp	12
Garden Acres	12
Henderson Village	12
Holt	12
Lathrop	12
Lincoln Village	12
Linden	12
Lockeford	12
Lodi	12
Manteca	12
Middle River	12
Middle River Town	12
Mokelumne River	12
Morada	12
Mormon Slough	12
Old River	12
Peters	12
Ripon	12
Sharpe Army Depot	12
Stockton	12
Terminous	12
Thornton	12
Tracy Carbona	12
Turner	12
U.S.N. Communication	12
Vernalis	12
Victor	12
Waterloo	12
Woodbridge	12
San Luis Obispo County (Zone 4, 5)	
Adelaida	4
Arroyo Grande	5
Atascadero	4
Avila Beach	5
Baywood Park	5
Caliente Range	4
California Valley	4
Cambria	5
Carrizo Plain	4
Cayucos	5
Cerro Alto	4
Cholame	4
Creston	4
Cuesta Pass	4
Cuyama Valley	4
Edna	5
El Paso de Robles	4
Estero Bay	5
Estrella	4
Estrella River	4
Grover Beach	5
Grover City	5
Harmony	5
Hog Canyon	4
Huasna	5
Huasna River	5
Irish Hills	5
La Panza Range	4
Lopez Lake	5
Los Berros Canyon	5
Los Osos	5
McMillan Canyon	4
Morales Canyon	4
Morro Bay	5
Nacimiento Reservoir	4
Nacimiento River	4
Nipomo	5
Oceano	5
Paso Robles AP	4
Pine Canyon	4
Pine Mountain	4
Pismo Beach	5
Point Buchon	5
Point Piedras Blancas	5
Pozo	4
San Luis Obispo	5
San Luis Obispo Bay	5
San Miguel	4
San Simeon	5
Santa Margarita	4
Santa Margarita Lake	4
Santa Maria River	5
Shandon	4
Shedd Canyon	4
Simmler	4
Soda Lake	4
Taylor Canyon	4
Templeton	4
Tucker Canyon	4
Whale Rock Reservoir	5
Whitley Gardens	4

City	CZ
San Mateo County (Zone 3)	
Atherton	3
Belmont	3
Brisbane	3
Burlingame	3
Colma	3
Crystal Springs Reservoir	3
Daly City	3
East Palo Alto	3
El Granada	3
Foster City	3
Half Moon Bay	3
Hillsborough	3
La Honda	3
Loma Mar	3
Menlo Park	3
Millbrae	3
Miramar	3
Montara	3
Moss Beach	3
Pacifica	3
Pescadero	3
Pigeon Point	3
Pillar Point	3
Portola Valley	3
Redwood City	3
San Andreas Lake	3
San Bruno	3
San Carlos	3
San Gregorio	3
San Mateo	3
South San Francisco	3
U.S.N. Facility, San Bruno	3
Woodside	3
Santa Barbara County (Zone 4, 5,6)	
Agua Caliente Canyon	5
Betteravia	5
Buellton	5
Cachuma Lake	5
Capitan	6
Carpinteria	6
Casmalia	5
Concepcion	6
Cuyama	4
Cuyama Valley	4
Drake	6
Foxen Canyon	5
Garey	5
Gaviota	6
Gaviota Pass	6
Goleta	6
Guadalupe	5
Honda	5
Isla Vista	6

City	CZ
Jalama	5
Lake Cachuma	5
Las Cruces	5
Lompoc	5
Los Alamos	5
Los Olivos	5
Montecito	6
Naples	6
New Cuyama	4
Orcutt	5
Pine Canyon	5
Point Arguello	5
Point Conception	6
Point Sal	5
Purisma Hills	5
San Miguel Island	6
San Rafael Mountain	5
Santa Barbara	6
Santa Barbara Island	6
Santa Cruz Island	6
Santa Maria	5
Santa Maria River	5
Santa Maria Valley	5
Santa Rosa Islands	6
Santa Ynez	5
Santa Ynez Mountains	5
Santa Ynez River	5
Sisquoc	5
Sisquoc River	5
Solvang	5
Summerland	6
Surf	5
Tajiguas	6
Tepusquet Canyon	5
Tequspuet Peak	5
Twitchell Reservoir	5
Vandenberg Air Force	5
Vandenburg Village	5
Ventupopa	4
Santa Clara County (Zone 4)	
Almaden A.F.S.	4
Alviso	4
Anderson Lake	4
Arroyo Hondo	4
Bell Station	4
Berryessa	4
Calaveras Reservoir	12/4
Campbell	4
Coyote	4
Cupertino	4
Diablo Range	4
Gilroy	4
Loma Prieta	4
Los Altos	4

City	CZ
Los Altos Hills	4
Los Gatos	4
Milpitas	4
Moffett Field Naval Air	4
Monta Vista	4
Monte Sereno	4
Morgan Hill	4
Mount Hamilton	4
Mount Hermon	3
Mountain View	4
New Almaden	4
Pacheco Pass	4
Palo Alto	4
Redwood Estates	4
San Felipe	4
San Jose	4
San Martin	4
Santa Clara	4
Santa Clara Valley	4
Saratoga	4
Sargent	4
Stanford	4
Sunnyvale	4
Sunnyvale Air Force	4
Svedal	4
U.S.N. Facility, Sunnyvale	4
Santa Cruz County (Zone 3)	
Aptos	3
Ben Lomond	3
Big Basin	3
Bonny Doon	3
Boulder Creek	3
Brookdale	3
Capitola	3
Corralitos	3
Davenport	3
Felton	3
Freedom	3
La Selva Beach	3
Live Oak	3
Monterey Bay	3
Opal Cliffs	3
Rio Del Mar	3
San Lorenzo River	3
Santa Cruz	3
Santa Cruz Mountains	3
Scotts Valley	3
Soquel	3
Swanton	3
Twin Lakes	3
Watsonville	3
Shasta County (Zone 11, 16)	
Anderson	11

City	CZ
Beegum	11
Bella Vista	11
Big Bend	16
Big Lake	16
Bollibokka Mountain	16
Buckeye	11
Burney	16
Burney Mountain	16
Cassel	16
Castella	16
Cayton	16
Centerville	11
Central Valley	11
Cloverdale	11
Cottonwood	11
Dana	16
Delta	16
Enterprise	11
Fall River	16
Fall River Mills	16
Fern	11
French Gulch	11
Gas Point	11
Girvan	11
Glenburg	16
Hat Creek	16
Igo	11
Ingot	11
Inwood	11
Iron Mountain	11
Keswick	11
Knob	16
Lake Britton	16
Lakehead	16
Lamoine	16
Lassen Peak	16
Manzanita Lake	16
Matheson	11
McArthur	16
McCloud River	16
Millville	11
Montgomery Creek	16
Mountain Gate	11
Oak Run	11
Obie	16
O'Brien	16
Old Station	16
Olinda	11
Ono	11
Palo Cedro	11
Pittville	16
Platina	11
Project City	11
Redding	11
Round Mountain	16
Shasta	11
Shasta Bally	11
Shasta Lake	16
Shingletown	16
Summit City	11
Trinity Mountains	16
Turntable Creek	11
Viola	16
Whiskeytown	11
Whiskeytown Lake	11
Sierra County (Zone 16)	
Alleghany	16
Calpine	16
Downie River	16
Downieville	16
Forest	16
Gibsonville	16
Goodyears Bar	16
Jackson Meadows	16
Little Truckee River	16
Loyalton	16
Purdy	16
Sardine Peak	16
Sattley	16
Sierra Buttes	16
Sierra City	16
Sierra Valley	16
Sierraville	16
Stampede Reservoir	16
Siskiyou County (Zone 16)	
Ager	16
Bartle	16
Beswick	16
Big Springs	16
Black Bear	16
Bolam	16
Bray	16
Butte Valley	16
Callahan	16
Cascade Range	16
Cecilville	16
Condrey Mountain	16
Copco	16
Cottage Grove	16
Cougar	16
Curtis	16
Deetz	16
Dorris	16
Dunsmuir	16
Dwinnell Reservoir	16
Edgewood	16
Erickson	16
Etna	16
Forks of Salmon	16
Fort Goff	16
Fort Jones	16
Gazelle	16
Goosenest	16
Grass Lake	16
Greenview	16
Grenada	16
Hambone	16
Hamburg	16
Happy Camp	16
Hawkinsville	16
Hilt	16
Hornbrook	16
Horse Creek	16
Hotlum	16
Jerome	16
Kinyon	16
Klamath Mountains	16
Klamath River	16
Klamathon	16
Lake Mountain	16
Little Shasta	16
Little Shasta River	16
Lower Klamath Lake	16
Macdoel	16
May	16
McCloud	16
Meiss Lake	16
Montague	16
Mount Eddy	16
Mount Hebron	16
Mount Hoffman	16
Mount Shasta	16
Mugginsville	16
Oro Fino	16
Pierce	16
Pondosa	16
Preston Peak	16
Russian Peak	16
Salmon Mountain	16
Salmon River	16
Salmon River (East Fork)	16
Salmon River (North Fork)	16
Salmon River (South Fork)	16
Sawyers Bar	16
Scott Bar	16
Scott Bar Mountains	16
Scott River	16
Scott River (East Fork)	16
Seiad Valley	16
Shasta River	16
Shasta Springs	16
Shasta Valley	16
Sheep Mountain	16

City	CZ
Siskiyou Mountains	16
Snowden	16
Somes Bar	16
Tecnor	16
Tennant	16
Tule Lake Sump	16
Tulelake	16
Weed	16
Wyntoon	16
Yreka	16
Solano County (Zones 3, 12)	
Allendale	12
Benicia	12
Birds Landing	12
Collinsville	12
Cordelia	12
Deep Water Ship Channel	12
Denverton	12
Dixon	12
Dozler	12
Elmira	12
Fairfield	12
Gillespie Field	12
Grizzly Bay	12
Honker Bay	12
Liberty Farms	12
Libfarm	12
Mare Island Naval Facility	3
Montezuma	12
Montezuma Slough	12
Monticello Dam	2
Oxford	12
Putah South Canal	12
Rio Vista	12
Rockville	12
Suisun Bay	12
Suisun City	12
Travis A. F.B.	12
Tremont	12
U.S.N. Facility, Vallejo	3
Vacaville	12
Vallejo	3
Yolo Bypass	12
Sonoma County (Zones 1, 2)	
Annapolis	1
Asti	2
Big Bend	2
Big Mountains	2
Bloomfield	2
Bodega	1
Bodega Bay	1
Bodega Head	1
Boyes Hot Springs	2

City	CZ
Camp Meeker	2
Cazadero	1
Cloverdale	2
Cotati	2
Cunningham	2
Duncans Mills	1
El Verano	2
Fairville	2
Forestville	2
Fort Ross	1
Freestone	2
Fulton	2
Geyserville	2
Glen Ellen	2
Graton	2
Guerneville	2
Hacienda	2
Healdsburg	2
Jenner	1
Jimtown	2
Kenwood	2
Lakeville	2
Larksfield-Wikiup	2
Lucas Vly-Marinwood	2
Lytton	2
Monte Rio	2
Mount Saint Helena	2
Occidental	2
Ocean View	1
Penngrove	2
Petaluma	2
Petaluma River	2
Plantation	1
Rio Nido	2
Rohnert Park	2
Roseland	2
Santa Rosa	2
Schellville	2
Sebastopol	2
Skaggs Springs	2
Soda Springs	1
Sonoma	2
Sonoma Mountain	2
Stewarts Point	1
Two Rock	2
Valley Ford	2
Windsor	2
Stanislaus County (Zone 12)	
Ceres	12
Chemurgic	12
Crows Landing	12
Denair	12
Empire	12
Eugene	12

City	CZ
Grayson	12
Hickman	12
Hills Ferry	12
Hughson	12
Keyes	12
Knights Ferry	12
La Grange	12
Modesto	12
Modesto Reservoir	12
Montpelier	12
Newman	12
Oakdale	12
Orestimba Peak	12
Patterson	12
Paulsell	12
Riverbank	12
Riverbank Army Depot	12
Salida	12
South Turlock	12
Turlock	12
Turlock Lake	12
Valley Home	12
Warnersville	12
Waterford	12
West Modesto	12
Westley	12
Sutter County (Zone 11)	
Auburn Ravine	11
Bear River	11
Catlett	11
Cranmore	11
East Nicolaus	11
Feather River	11
Josephine	11
Kirkville	11
Kirkwood	11
Live Oak	11
Lomo	11
Meridian	11
Morrison Slough	11
Nicolaus	15
Pennington	11
Pleasant Hill	11
Rio Oso	11
Robbins	11
Snake River	11
South Yuba City	11
Sutter	11
Sutter Buttes	11
Sutter Bypass	11
Trowbridge	11
Tudor	11
Verona	11
Yuba City	11

City	CZ
Tehama County (Zone 11, 16)	
Barkley Mountain	16
Bend	11
Black Butte Reservoir	11
Blossom	11
Blunt	11
Corning	11
Corning Canal	11
Dairyville	11
Dales	11
Flournoy	11
Gerber	11
Henleyville	11
Hooker	11
Inskip Hill	11
Los Molinoss	11
Lowrey	11
Lyonsville	16
Manton	16
Mill Creek	16
Mineral	16
North Yolla Bolly	16
Paskenta	11
Paynes Creek	11
Proberta	11
Red Bank	11
Red Bluff	11
Richfield	11
Rosewood	11
Saint Bernard	16
South Yolla Bolly	16
Tehama	11
Vina	11
Trinity County (Zone 2, 16)	
Big Bar	16
Bonanza King	16
Burnt Ranch	16
Carrville	16
Chanchelulla Peak	16
China Peak	16
Clair Engle Lake	16
Covington Mill	16
Deadwood	16
Dedrick	16
Del Loma	16
Denny	16
Douglas City	16
Forest Glen	16
Gibson Peak	16
Hayfork	16
Hayfork Bally	16
Helena	16
Hyampom	16
Island Mountain	2
Junction City	16
Kekawaka	2
Kettenpom	2
Lewiston	16
Lewiston Lake	16
Mount Eddy	16
New River	16
Peanut	16
Ruth	16
Salyer	16
Scott Mountains	16
Trinity Alps	16
Trinity Center	16
Trinity Dam	16
Trinity Mountains	16
Trinity River (East Fork)	16
Weaverville	16
Zenia	2
Tulare County (Zone 13, 16)	
Allensworth	13
Alpaugh	13
Angiola	13
Ash Mountain	13
Badger	13
California Hot Springs	16
Camp Nelson	16
Cutler	13
Dinuba	13
Ducor	13
Earlimart	13
East Porterville	13
Elderwood	13
Elk Bayou	13
Exeter	13
Fairview	16
Farmersville	13
Florence Peak	16
Fountain Springs	13
Fountain Springs Gulch	13
Giant Forest	16
Goshen	13
Grant Grove	16
Greenhorn Mountains	16
Ivanhoe	13
Johnsondale	16
Kaweah	13
Kaweah River (Middle	16
Lake Kaweah	13
Lake Success	13
Lemoncove	13
Lindcove	13
Lindsay	13
Little Kern River	16
Milo	13
Mineral King	16
Monson	13
Mount Whitney	16
New London	13
Olancha Peak	16
Orosi	13
Pine Flat	16
Pixley	13
Plainview	13
Poplar	13
Porterville	13
Posey	13
Quedow Mountain	13
Richgrove	13
Saint Johns River	13
Sherman Peak	16
Silver City	16
Springville	13
Strathmore	13
Sultana	13
Tagus	13
Terminus Dam	13
Terra Bella	13
Three Rivers	13
Tipton	13
Tobias Peak	16
Traver	13
Tulare	13
Visalia	13
Waukena	13
White River (Town)	13
Wilsonia	16
Woodlake	13
Woodville	13
Yettem	13
Yucca Mountain	16
Tuolumne County (Zone 12, 16)	
Aspen Valley	16
Beardsley Lake	16
Big Oak Flat	12
Cherry Lake	16
Chinese Camp	12
Clavey River	16
Cold Springs	16
Columbia	12
Dardanelle	16
Groveland	12
Harden Flat	16
Hetch Hetchy Junction	12
Hetch Hetchy Reservoir	16
Jacksonville	12
Jamestown	12
Lake Eleanor	16

City	CZ
Leavitt Peak	16
Long Barn	16
Mather	16
Matterhorn Peak	16
Melones Reservoir	12
Middle Tuolumne River	16
Mi-Wuk Village	12
Moccasin	12
New Don Pedro Reservoir	12
Pilot Peak	16
Pinecrest	16
Sonora	12
Sonora Pass	16
Soulsbyville	12
South Entry Yosemite	16
Standard	12
Stanislaus River (Middle	16
Stent	12
Strawberry	16
Tioga Pass	16
Tuolumne	12
Tuolumne Meadows	16
Tuolumne River (North	16
Tuolumne River (South	16
Tuttletown	12
Twain Harte	12
White Wolf	16
Ventura County (Zones 6, 9, 16)	
Anacapa Island	6
Apache Canyon	16
Bardsdale	9
Camarillo	6
Casitas Springs	9
Cuddy Canyon	16
Dry Canyon	16
El Rio	6
Fillmore	9
Frazier Mountain	16
Hollywood-by-the-Sea	6
Lake Casitas	9
Meiners Oaks	9
Montalvo	6
Moorpark	9
Mount Pinos	16
Newbury Park	9
Oak Ridge	9
Oak View	9
Ojai	9
Oxnard	6
Oxnard Beach	6
Pine Mountain	16
Piru	9
Point Mugu	6
Point Mugu Naval Missile	6
Port Hueneme	6
Quatal Canyon	16
San Buenaventura	6
San Nicholas Island	6
Santa Clara River	6/9
Santa Paula	9
Santa Susana	9
Saticoy	6
Sea Cliff	6
Sespe	9
Simi Valley	9
Solromar	6
Somis	6
Sulphur Springs	9
Thousand Oaks	9
U.S.N. Construction	6
U.S.N. Facility, San Nicolas	6
Ventura	6
Wheeler Springs	16
Yolo County (Zone 2, 3, 12)	
Berryessa Peak	2/12
Broderick	12
Brooks Ranch	12
Bryte	12
Capay	12
Clarksburg	12
Colusa Basin Drainage	12
Davis	12
Deep Water Ship Channel	12
Dunnigan	12
Esparto	12
Guinda	12
Knights Landing	12
Madison	12
Rumsey	12
Tule Canal	12
West Sacramento	12
Winters	12
Woodland	12
Yolo	12
Yolo Bypass	12
Zamora	12
Yuba County (Zone 11, 16)	
Beale Air Force Base	11
Bear River	11
Browns Valley	11
Brownsville	11
Camp Far West Reservoir	11
Camptonville	16
Challenge	16
Dobbins	11
Hammonton	11
Linda	11
Loma Rica	11
Marysville	11
Merle Collins Reservoir	11
Middle Yuba River	16
New Bullards Bar	16
North Yuba River	16
Olivehurst	11
Oregon House	11
Oregon Peak	16
Racherby	11
Smartville	11
Strawberry Valley	16
Tambo	11
Wheatland	11
Woodleaf	16

II.3 California Design Location Data

The data contained in the following table was obtained through a joint effort by the Southern California Chapter and the Golden Gate Chapter of ASHRAE. It is reprinted here with the written permission of Southern California Chapter ASHRAE, Inc.

A full listing of design location data for California is contained in the ASHRAE publication *SPCDX, Climate Data for Region X, Arizona, California, Hawaii, and Nevada* (May 1982). The publication may be ordered from:

Order Desk
Building News
10801 National Blvd.
Los Angeles, CA 90064
(800) 873-6397 or (310) 474-7771
Cost: $17.50 + tax + $4.25 shipping and handling

Table II.3 – Design Day Data for California Cities

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Alameda	Alameda NAS	3	37.79	122.3	15	88	65	82	64	76	62	21	35	2507
Alameda	Albany	3	37.90	122.2	40	88	65	83	64	77	62	16	30	
Alameda	Ashland	3	37.7	122.1	45	92	66	86	65	81	62	24	26	
Alameda	Berkeley	3	37.90	122.2	345	90	64	83	63	76	61	16	33	2950
Alameda	Castro Valley	3	37.59	122.2	177	93	67	87	67	80	65	25	24	
Alameda	Cherryland	3	37.5		100	93	67	86	66	79	64	24	26	
Alameda	Dublin	12	37.70	121.5	200	99	69	93	67	86	65	35	24	
Alameda	Fremont	3	37.5	122.0	56	94	67	88	65	81	63	24	25	
Alameda	Hayward	3	37.70	122.1	530	92	66	86	65	81	62	24	26	2909
Alameda	Livermore	12	37.70	121.9	490	100	69	95	68	88	67	35	22	3012
Alameda	Newark	3	37.5	122.0	10	94	68	89	67	82	65	24	29	
Alameda	Oakland AP	3	37.70	122.2	6	91	66	84	64	77	62	20	32	2909
Alameda	Oakland Museum	3	37.79	122.1	30	96	68	89	66	82	63	20	31	
Alameda	Piedmont	3	37.79	122.0	325	96	68	89	66	82	63	23	31	
Alameda	Pleasanton	12	37.59	121.7	350	97	68	94	67	89	65	35	24	
Alameda	San Leandro	3	37.70	122.1	45	89	67	83	64	76	62	22	28	
Alameda	San Lorenzo	3	37.70	122.0	45	89	67	83	64	76	62	23	28	
Alameda	Union City	3	37.6	122.0	5	90	67	87	66	81	63	20	25	
Alameda	Upper San Leandro	3	37.79		394	93	67	87	66	80	63	22	28	
Alpine	Woodfords	16	38.79	119.8	5671	92	59	89	58	84	56	32	0	6047
Amador	Electra PH	12	38.29	120.6	715	106	70	102	69	98	68	41	23	2858
Amador	Ione	12	38.3	120.9	298	101	70	97	68	91	67	38	23	
Amador	Tiger Creek PH	12	38.5	120.4	2355	100	66	96	55	92	63	36	20	3795
Amador/Calavaras	Salt Springs PH	16	38.5	120.2	3700	95	62	92	61	87	59	27	19	3857
Butte	Centerville PH	11	39.79	121.6	522	105	70	100	68	96	67	40	25	2895
Butte	Chico Exp Sta	11	39.70	121.7	205	105	70	102	69	96	68	37	22	2878
Butte	De Sabla	11	39.90	121.6	2713	97	66	94	64	88	62	35	18	4237
Butte	Las Plumas	11	39.70		506	104	71	101	70	96	68	32	24	
Butte	Oroville East	11	39.5		171	106	71	104	70	98	69	37	25	
Butte	Oroville RS	11	39.5	121.5	300	106	71	104	70	98	69	37	25	
Butte	Palermo	11	39.4	121.5	154	106	71	104	70	98	69	37	25	
Butte	Paradise	11	39.79	121.6	1750	102	69	99	67	94	66	34	25	

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Butte	South Oroville	11	39.5	121.5	174	106	71	104	70	98	69	37	25	
Butte	Thermalito	11	37.9	121.5	25	106	71	104	70	98	69	37	25	
Calaveras	Camp Pardee	12	38.20	120.8	658	106	71	103	70	98	69	36	27	2812
Colusa	Colusa	11	39.20	122.0	60	103	72	100	70	94	68	36	23	2793
Colusa	East Park Res	11	39.40	122.5	1205	101	69	97	68	92	66	38	19	3455
Colusa	Williams	11	39.20	122.1	85	104	71	100	70	94	68	36	24	
Colusa	Willows	11	39.5		140	104	71	100	70	94	68	36	22	2836
Contra Costa	Alamo	12	37.90	122.9	410	102	69	97	68	92	66	30	23	
Contra Costa	Antioch	12	38	121.7	60	102	70	97	68	91	66	34	22	2627
Contra Costa	Blackhawk	12	37.7		10	88	65	82	64	76	62	21	35	
Contra Costa	Brentwood	12	37.9	121.6	71	102	70	97	68	89	65	34	27	
Contra Costa	Clayton	12	38	121.9	60	102	70	97	68	89	65	34	27	
Contra Costa	Concord	12	38	112.0	195	102	70	97	68	89	65	34	27	3035
Contra Costa	Crockett	12	38	122.2	9	96	68	90	66	85	64	23	28	
Contra Costa	Danville	12	37.8	122.0	368	102	69	97	68	92	66	30	23	
Contra Costa	Discovery Bay	12	38.1	121.6	10	102	70	97	68	89	65	34	27	
Contra Costa	El Cerrito	3	37.79	122.3	70	91	66	84	64	75	62	17	30	
Contra Costa	El Sobrante	3	37.9	122.2	55	91	66	87	65	82	64	25	30	
Contra Costa	Hercules	3	38	122.2	15	91	66	87	65	82	64	25	30	
Contra Costa	Lafayette	12	37.90	122.1	535	100	69	94	67	87	66	32	24	
Contra Costa	Martinez FS	12	38	122.1	40	99	67	94	66	88	65	36	28	
Contra Costa	Moraga	12	37.79	122.1	600	99	68	93	66	86	64	27	21	
Contra Costa	Mount Diablo	12	37.90	121.9	2100	101	68	96	66	87	65	28	27	4600
Contra Costa	Oakley	12	38	121.7	20	102	70	97	68	91	66	34	22	
Contra Costa	Orinda	12	37.90	122.1	550	99	68	93	66	86	64	32	21	
Contra Costa	Pinole	3	38	122.3	10	91	66	87	65	82	64	25	30	
Contra Costa	Pittsburg	12	38	121.8	50	102	70	97	68	90	67	34	26	
Contra Costa	Pleasant Hill	12	37.90	122.0	102	96	68	93	67	88	65	34	25	
Contra Costa	Port Chicago ND	12	38	122.0	50	98	69	94	68	88	66	34	28	
Contra Costa	Richmond	3	37.90	121.6	55	88	65	84	64	77	62	17	31	2684
Contra Costa	Rodeo	3	38.1	122.2	15	93	67	90	66	84	64	23	28	
Contra Costa	Saint Mary's College	12	37.79	122.1	623	98	69	93	68	86	66	28	21	3543
Contra Costa	San Pablo	3	37.59	122.3	30	90	65	84	63	77	61	17	29	
Contra Costa	San Ramon	12	37.7	121.9	360	99	69	93	67	86	65	35	24	
Contra Costa	Walnut Creek	12	37.90	122.0	245	100	69	94	67	87	66	32	23	
Contra Costa	West Pittsburg	12	38	121.9	12	102	70	97	68	90	67	34	26	
Del Norte	Crescent City	1	41.79	124.2	40	75	61	69	59	65	58	18	28	4445
Del Norte	Elk Valley	16	42	123.7	1705	96	65	90	63	84	61	39	16	5404
Del Norte	Idlewild	1	41.90	124.0	1250	103	68	96	66	92	65	40	18	
Del Norte	Klamath	1	41.5	124.0	25	79	62	71	60	66	58	18	26	4509
El Dorado	Cameron Park	12	38.6	120.9	1800	101	67	98	66	93	65	42	20	
El Dorado	El Dorado Hills	12	38.6		673	103	70	100	69	94	67	36	24	
El Dorado	Georgetown RS	12	38.90	120.7	3001	98	64	95	63	90	61	31	18	
El Dorado	Placerville	12	38.70	120.8	1890	101	67	98	66	93	65	42	20	4086
El Dorado	Placerville IFG	12	38.70	120.8	2755	100	66	97	65	92	64	42	23	
El Dorado	South Lake Tahoe	16	38.90	119.9	6200	85	56	82	55	71	54	33	-2	
Fresno	Auberry	13	37.09	119.5	2140	102	69	98	67	95	64	36	21	3313
Fresno	Bonadella Ranchos – Madera Rancho	13	36.8		270	105	72	101	70	96	68	40	24	
Fresno	Calwa	13	36.79	119.7	330	105	73	101	71	97	68	34	23	
Fresno	Clovis	13	36.79	119.7	404	105	72	102	70	98	68	36	22	

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Fresno	Coalinga	13	36.20	120.3	671	103	70	98	70	93	69	34	23	2592
Fresno	Five Points	13	36.40	120.1	285	103	71	99	70	93	68	36	21	
Fresno	Fresno AP	13	36.79	119.7	328	104	73	101	71	97	68	34	24	2650
Fresno	Friant Gov Camp	13	37	119.7	410	106	72	103	70	100	68	40	23	2768
Fresno	Huntington Lake	16	37.20	119.2	7020	80	55	77	54	73	51	25	3	7632
Fresno	Kerman	13	36.6	120.0	216	105	73	101	71	97	68	34	24	
Fresno	Kingsburg	13	36.4	119.5	297	104	73	101	71	97	69	36	24	
Fresno	Lakeshore	16	40.90	119.1	1075	104	69	100	68	95	66	28	29	
Fresno	Little Panoche	13	36.79		677	100	68	94	67	86	66	33	23	
Fresno	Mendota	13	36.7	120.3	169	105	73	101	71	97	68	34	24	
Fresno	Miramonte	13	34.4	119.0	750	102	71	97	69	91	68	38	25	
Fresno	Orange Cove	13	36.59	119.3	431	104	71	100	69	97	68	38	25	2684
Fresno	Parlier	13	36.6	119.5	320	104	73	101	71	97	68	38	24	
Fresno	Reedley	13	36.59	119.7	344	104	71	101	70	96	68	40	24	
Fresno	Sanger	13	36.70	119.5	364	105	72	101	70	96	68	37	24	
Fresno	Selma	13	36.59	119.6	305	104	73	101	71	97	68	38	24	
Glenn	Orland	11	39.79	122.2	254	105	71	102	70	97	68	36	22	2824
Glenn	Stony Gorge Res	11	39.59	122.5	791	104	70	99	69	93	67	37	21	3149
Humboldt	Alderpoint	2	40.20	123.6	460	100	69	95	67	90	65	39	21	3424
Humboldt	Arcata	1	41	124.1	218	75	61	69	59	65	58	11	28	5029
Humboldt	Butler Valley (Korbel)	1	40.7	123.9	420	91	66	86	64	81	62	22	20	
Humboldt	Eureka	1	40.79	124.1	43	75	61	69	59	65	58	11	30	4679
Humboldt	Ferndale	1	40.5	124.3	1445	76	57	66	56	62	54	12	28	
Humboldt	Fortuna	1	40.6	124.1	100	75	61	69	59	65	58	11	30	
Humboldt	Hoopa	2	41	123.6	360	100	67	92	66	87	64	25	23	
Humboldt	McKinleyville	1	40.9	124.1	33	75	61	69	59	65	58	11	28	
Humboldt	Orick Prairie Creek	1	41.40	124.0	161	80	61	75	60	70	59	23	25	4816
Humboldt	Orleans	2	41.29	123.5	403	104	70	97	68	91	66	42	21	3628
Humboldt	Scotia	1	40.5	124.3	139	78	61	74	60	69	58	19	28	3954
Humboldt	Shelter Cove	1	40	124.0	110	80	61	73	60	68	57	15	34	
Humboldt	Willow Creek	2	41	123	461	104	70	98	68	92	66	35	22	
Humbolt	Richardson Grove	2	40	123.7	500	96	67	92	66	87	64	28	25	
Imperial	Brawley 2 SW	15	33	115.5	-100	113	74	110	73	105	73	32	25	1204
Imperial	Calexico	15	32.70	115.5	12	114	74	110	73	106	71	28	26	
Imperial	El Centro	15	32.79	115.5	-30	115	74	111	73	107	73	34	26	1212
Imperial	Gold Rock Rch	15	32.90		485	113	73	110	72	106	70	28	31	
Imperial	Imperial AP	15	32.79	115.5	-59	114	74	110	73	106	72	31	26	1060
Imperial	Imperial CO	15	32.90		-64	112	73	108	72	104	71	31	29	976
Inyo	Bishop AP	16	37.40	118.3	4108	103	61	100	60	97	58	40	5	4313
Inyo	Death Valley	14	36.5	116.8	-194	121	77	118	76	114	74	28	27	1147
Inyo	Deep Springs Clg	16	37.5	117.9	5225	98	60	95	59	92	58	35	-3	
Inyo	Haiwee	16	36.09	117.9	3825	102	65	99	64	95	62	27	15	3700
Inyo	Independence	16	36.79	118.2	3950	104	61	101	60	97	60	31	12	
Inyo	Wildrose RS	16	36.29		4100	100	64	97	63	93	61	33	13	
Kern	Alta Sierra	16	35.7	118.5	6500	87	62	84	61	80	59	32	-4	
Kern	Arvin	13	35.20	118.8	445	106	71	102	69	98	68	30	26	
Kern	Bakersfield AP	13	35.40	119.0	475	106	71	102	70	98	68	34	26	2185
Kern	Blackwells Corner	13	35.59	119.9	644	99	68	94	66	89	65	31	23	
Kern	Boron AFS	14	35.09	117.5	3015	106	70	103	69	98	68	35	18	3000
Kern	Buttonwillow	13	35.40	119.4	269	103	71	99	70	95	68	36	20	2621
Kern	California City	14	35.1	117.9	2400	107	69	104	68	99	66	33	10	

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Kern	Cantil	14	35.29	117.9	2010	111	71	107	71	103	70	32	12	
Kern	Delano	13	35.79	119.2	323	106	71	102	70	98	69	36	22	
Kern	Edwards AFB	14	34.90	117.8	2316	107	69	104	68	99	66	35	10	3123
Kern	Glennville	16	35.70	118.7	3140	97	67	94	66	90	64	43	11	4423
Kern	Golden Hills	16	35.1		4000	97	66	93	65	89	64	33	13	
Kern	Greenacres	13	35.3	119.1	400	106	71	102	70	98	68	34	26	
Kern	Hillcrest Center	16	35.40		500	106	71	102	70	98	68	34	26	
Kern	Inyokern NAS	14	35.70	117.8	2440	110	71	106	68	102	66	37	15	2772
Kern	Kern River PH 3	16	35.79	118.5	2703	103	69	100	68	96	66	34	19	2891
Kern	Lamont	13	35.29	120.0	500	106	72	102	71	98	69	34	26	
Kern	Maricopa	13	35.09	119.3	675	106	71	102	70	98	68	29	25	2302
Kern	McFarland	13	35.6	119.2	350	106	71	102	70	98	69	36	22	
Kern	Mojave	14	35.09	118.1	2735	106	68	102	67	98	66	35	16	3012
Kern	Oildale	13	35.5	119.0	450	106	71	102	70	98	68	34	26	
Kern	Randsburg	14	35.29	117.6	3570	105	67	102	66	97	65	30	19	2922
Kern	Ridgecrest	14	35.59	117.8	2340	110	70	106	68	102	66	35	15	
Kern	Rosamond	14	34.8	118.1	2326	106	68	102	67	98	66	35	16	
Kern	Shafter	13	35.5	119.1	345	106	71	102	70	98	68	28	24	2185
Kern	Taft	13	35.1	119.4	987	106	71	102	70	98	68	34	26	
Kern	Tehachapi	16	35.09	118.4	3975	97	66	93	65	89	64	33	13	4494
Kern	Wasco	13	35.59	119.3	333	105	71	101	70	97	68	36	23	2466
Kings	Avenal	13	36	120.1	550	103	70	98	70	93	69	34	23	
Kings	Corcoran	13	36.09	119.7	200	106	72	102	71	98	70	36	22	2666
Kings	Hanford	13	36.29	119.6	242	102	71	99	70	94	68	37	22	2736
Kings	Kern River PH 1	13	35.5	118.7	970	106	72	103	71	99	69	26	30	1878
Kings	Kettleman Stn	13	36.09	120.0	508	104	71	100	70	93	68	31	26	2180
Kings	Lemoore NAS	13	36.29	119.9	228	104	72	101	71	97	69	37	19	2960
Lake	Clearlake Highlands	2	39	122.7	1360	101	69	97	68	89	65	36	15	
Lake	Lakeport	2	39	122.9	1347	97	67	93	66	88	63	41	20	3728
Lake	Upper Lake RS	2	39.20	122.9	1347	98	68	95	67	91	64	39	18	
Lassen	Doyle	16	40	120.1	4390	96	63	93	62	88	59	42	0	
Lassen	Fleming Fish & Game	16	40.40	120.3	4000	96	62	93	61	88	59	40	-3	
Lassen	Lodgepole	16	36.59	118.7	6735	84	57	80	56	78	54	26	-4	
Lassen	Susanville AP	16	40.40	120.5	4148	98	62	95	61	90	59	38	-1	6233
Los Angeles	Agoura Hills	9	34.2	118.7	700	103	70	96	68	90	66	29	27	
Los Angeles	Alhambra	9	34	118.1	483	100	71	96	70	90	68	25	30	
Los Angeles	Alondra Park	6	33.90	118.3	50	91	69	86	68	81	66	17	35	
Los Angeles	Altadena	9	34.20	118.1	1200	99	68	94	67	88	66	31	32	1920
Los Angeles	Arcadia	9	34.20	118.0	475	100	69	96	68	91	67	30	31	
Los Angeles	Artesia	8	33.79	118.0	50	99	71	91	70	85	68	23	33	
Los Angeles	Avalon	6	33.40	118.3	25	83	64	75	62	69	60	11	37	2204
Los Angeles	Avocado Heights	16	34.2	117.9	550	101	69	97	68	91	68	30	28	
Los Angeles	Azusa	9	34.09	118.1	605	101	70	97	69	91	68	36	31	
Los Angeles	Baldwin Park	9	34	117.9	394	100	69	96	69	90	68	32	31	
Los Angeles	Bell	8	33.90	118.1	143	97	70	91	69	85	67	22	33	
Los Angeles	Bell Gardens	8	33.90	118.1	160	97	70	91	69	78	62	24	29	
Los Angeles	Bellflower	8	33.79	118.1	73	98	70	91	69	85	67	21	32	
Los Angeles	Beverly Hills	9	34.09	118.1	268	94	69	88	68	83	66	20	39	
Los Angeles	Burbank AP	9	34.20	118.3	699	101	70	96	68	90	67	28	29	1701
Los Angeles	Burbank Vly Pump	9	34.20	118.3	655	101	69	96	68	90	66	28	29	1678
Los Angeles	Calabasas	9	34.20	118.6	1100	102	71	98	70	93	69	26	26	2348

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Los Angeles	Canoga Park	9	34.20	118.5	790	104	71	99	70	93	69	38	25	1884
Los Angeles	Carson	6	33.79	118.2	60	96	69	88	68	82	66	19	33	
Los Angeles	Cerritos	8	33.90	118.0	34	99	71	92	69	85	68	23	33	
Los Angeles	Charter Oak	9	34.1	117.8	600	101	70	97	69	91	68	34	29	
Los Angeles	Chatsworth	9	34.2	118.6	964	98	69	93	68	87	66	38	26	
Los Angeles	Claremont	9	34.09	117.8	1201	101	69	97	68	91	66	34	29	2049
Los Angeles	Commerce	8	33.90	118.1	175	98	69	92	68	86	67	23	33	
Los Angeles	Compton	8	33.90	118.2	71	97	69	90	68	83	67	21	33	1606
Los Angeles	Covina	9	34.09	117.8	575	101	70	97	69	91	68	34	29	
Los Angeles	Cudahy	8	33.90	118.1	130	98	70	91	69	85	67	21	33	
Los Angeles	Culver City	8	34	118.4	106	96	70	88	69	83	67	18	35	1515
Los Angeles	Del Aire	6	34		100	91	69	84	67	79	66	15	37	
Los Angeles	Diamond Bar	9	34	117.8	880	101	69	97	68	92	66	33	28	
Los Angeles	Downey	8	33.90	118.0	110	98	71	90	70	84	68	21	32	
Los Angeles	Duarte	9	34.09	117.9	500	100	69	96	68	90	67	33	31	
Los Angeles	East Compton	8	34		71	97	69	90	68	83	67	21	33	
Los Angeles	East La Mirada	9	33.9		115	99	70	91	69	85	68	26	31	
Los Angeles	East Los Angeles	9	34	118.2	250	99	69	92	68	86	67	21	38	
Los Angeles	East Pasadena	16	34.2	118.0	864	99	69	94	68	88	67	30	32	
Los Angeles	East San Gabriel	9	34.1		450	99	70	94	69	88	68	30	30	
Los Angeles	El Monte	9	34.09	118.0	271	101	71	97	70	91	68	30	31	
Los Angeles	El Segundo	6	33.90	118.4	105	91	69	84	68	79	66	14	37	
Los Angeles	Encino	9	34.2	118.5	750	103	71	98	69	92	67	27	28	
Los Angeles	Fairmont	14	34.70	118.4	3060	100	67	96	66	92	65	22	22	3330
Los Angeles	Florence-Graham	8	34		175	98	69	90	68	84	67	19	35	
Los Angeles	Gardena	8	33.90	118.3	40	92	69	85	68	80	66	18	32	
Los Angeles	Glendale	9	34.20	118.2	563	101	70	96	68	90	67	28	30	
Los Angeles	Glendora	9	34.09	117.8	822	102	69	98	68	92	67	35	30	
Los Angeles	Granada Hills	6	34.4	118.5	1032	100	70	95	68	89	66	37	28	
Los Angeles	Hacienda Hts	9	34	117.9	300	100	69	96	68	90	67	28	31	
Los Angeles	Hawaiian Gardens	8	33.79	118.0	75	97	70	91	69	84	67	23	32	
Los Angeles	Hawthorne	8	33.90	118.3	70	92	69	85	68	80	66	16	37	
Los Angeles	Hermosa Beach	6	33.90	118.4	16	92	69	84	68	78	66	12	38	
Los Angeles	Hollywood	9	34	118.3	384	96	70	89	69	83	67	20	36	
Los Angeles	Huntington Park	8	34	118.0	175	98	70	90	69	84	67	20	38	
Los Angeles	Inglewood	8	33.90	118.0	105	92	68	85	67	80	65	15	37	
Los Angeles	La Canada-Flintridge	9	34.20	118.0	1365	99	69	95	68	88	66	30	32	
Los Angeles	La Crescenta-Montrose	9	34.20	118.0	1565	98	69	94	68	87	66	33	31	
Los Angeles	La Habra Heights	9	34	117.9	400	100	69	94	68	87	67	27	30	
Los Angeles	La Mirada	9	33.90	118.0	115	99	70	91	69	85	68	26	31	
Los Angeles	La Puente	9	34	118.0	320	101	71	97	70	91	69	28	31	
Los Angeles	La Verne	9	34.09	118.0	1235	101	69	97	68	91	67	34	29	
Los Angeles	Ladera Heights	9	34.1		100	91	67	84	67	79	66	14	37	
Los Angeles	Lake Los Angeles	14	34.7	117.8	2300	106	68	102	67	98	66	35	12	
Los Angeles	Lakewood	8	33.90	118.0	45	98	70	90	68	84	66	22	33	
Los Angeles	Lancaster	14	34.70	118.2	2340	106	68	102	67	98	66	35	12	
Los Angeles	Lawndale	8	33.90	118.0	66	92	69	85	68	80	66	16	37	
Los Angeles	Lennox	8	33.90	117.7	71	92	69	85	68	80	66	16	37	
Los Angeles	Llano Shawnee	14	34.5	117.7	3820	104	68	99	67	95	65	31	21	
Los Angeles	Lomita	6	33.79	119.0	56	95	69	87	68	81	66	18	33	
Los Angeles	Long Beach	6	33.70	118.1	34	97	70	88	68	82	65	18	35	

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Los Angeles	Long Beach AP	8	33.79	118.2	25	99	71	90	69	84	66	21	33	1606
Los Angeles	Los Angeles AP	6	33.90	118.4	97	91	67	84	67	79	66	14	37	1819
Los Angeles	Los Angeles CO	9	34	118.2	270	99	69	92	68	86	67	21	38	1245
Los Angeles	Lynwood	8	33.90	118.0	88	98	70	90	69	83	67	21	32	
Los Angeles	Manhattan Beach	6	33.90	118.0	120	91	69	84	68	79	66	12	38	
Los Angeles	Marina del Rey	9	34.1	118.4	40	91	69	84	68	79	66	12	38	
Los Angeles	Maywood	8	34	118.0	170	97	70	91	69	85	67	21	34	
Los Angeles	Monrovia	9	34.20	118.3	562	100	69	96	68	90	67	30	33	
Los Angeles	Montebello	9	34	118.1	205	98	69	93	68	86	67	24	33	
Los Angeles	Monterey Park	9	34	118.0	380	99	69	94	68	87	67	23	30	
Los Angeles	Mount Wilson	16	34.20	118.0	5709	90	63	85	61	79	58	21	15	4296
Los Angeles	Newhall Soledad	9	34.40	118.5	1243	104	70	100	68	95	67	42	27	
Los Angeles	North Hollywood	9	34.20	118.3	619	102	70	97	69	91	67	31	28	
Los Angeles	Northridge	9	34.2	118.5	875	101	70	96	69	90	67	36	30	
Los Angeles	Norwalk	8	33.9	118.0	97	99	69	90	68	84	67	26	31	
Los Angeles	Pacoima	16	34.26	118.4	895	104	71	99	70	94	68	35	29	
Los Angeles	Palmdale AP	14	34.59	118.1	2517	107	67	103	67	98	64	33	12	2929
Los Angeles	Palmdale CO	14	34.59	118.1	2596	106	67	102	67	97	64	35	13	2908
Los Angeles	Palos Verdes	6	33.79	119.0	216	92	69	84	68	78	66	14	38	
Los Angeles	Panorama City	9	34.22	118.4	801	103	71	98	69	92	67	32	28	
Los Angeles	Paramount	8	33.90	117.0	70	98	70	90	69	84	67	22	32	
Los Angeles	Pasadena	9	34.20	118.1	864	99	69	94	68	88	67	30	32	1551
Los Angeles	Pico Rivera	9	34	118.0	180	98	70	91	69	85	67	24	31	
Los Angeles	Pomona Cal Poly	9	34.09	117.8	740	102	70	98	69	93	67	36	27	1971
Los Angeles	Quartz Hill	14	34.6	118.2	2428	106	68	102	67	98	66	35	12	
Los Angeles	Rancho Palos Verdes	6	33.70	118.1	216	92	69	84	68	78	66	14	38	
Los Angeles	Redondo Beach	6	33.79	118.3	45	92	69	84	68	78	66	12	37	
Los Angeles	Reseda	9	34.2	118.5	736	103	71	98	69	92	67	32	28	
Los Angeles	Rolling Hills	6	33.59	119.0	216	92	69	84	68	78	66	15	38	
Los Angeles	Rosemead	9	34	118.0	275	98	70	90	69	84	67	27	30	
Los Angeles	Rowland Hts	9	33.90	118.0	540	99	70	93	69	86	68	27	29	
Los Angeles	San Antonio Canyon	16	34.20	117.6	2394	100	68	96	67	90	65	33	29	
Los Angeles	San Dimas	9	34	118.4	955	102	70	98	69	92	67	35	30	
Los Angeles	San Fernando	9	34.29	118.4	977	104	71	99	70	94	68	37	30	1800
Los Angeles	San Gabriel FD	9	34.09	118.1	450	99	70	94	69	88	68	30	30	1532
Los Angeles	San Marino	9	34.20	118.1	300	100	69	95	68	88	66	28	30	
Los Angeles	San Pedro	6	33.70	118.2	10	92	69	84	68	78	66	13	35	1819
Los Angeles	Sandberg	16	34.79	118.7	4517	95	63	91	61	87	59	32	17	4427
Los Angeles	Santa Clarita	9	34.4	118.5	1300	103	71	98	70	93	68	36	30	
Los Angeles	Santa Fe Springs	9	33.90	118.0	280	99	69	90	68	84	67	24	31	
Los Angeles	Santa Monica	6	34	118.5	15	85	67	78	66	72	64	15	39	1873
Los Angeles	Sepulveda	9	34.2	118.4	818	103	71	98	69	92	67	32	28	
Los Angeles	Sherman Oaks	9	34.2	118.4	657	103	71	98	69	92	67	28	29	
Los Angeles	Sierra Madre	9	34.20	118.0	1153	102	69	96	68	90	67	27	32	
Los Angeles	Signal Hill	6	33.5	118.1	100	99	70	90	69	84	66	19	35	
Los Angeles	South El Monte	9	34	118.0	270	101	72	97	70	91	68	28	31	
Los Angeles	South Gate	8	33.90	118.2	120	97	70	90	69	84	67	21	32	
Los Angeles	South Pasadena	9	34	118.1	657	99	69	94	68	88	67	30	31	
Los Angeles	South San Gabriel	9	34.1	118.0	450	99	70	94	69	88	68	73	30	
Los Angeles	South Whittier	9	33.90	118.0	300	100	70	92	69	84	68	30	31	
Los Angeles	Studio City	9	34.28	118.3	620	102	70	97	69	91	67	31	28	

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Los Angeles	Sunland	9	34.29	118.3	1460	107	71	102	70	96	68	36	28	
Los Angeles	Tarzana	6	34.18	118.5	800	104	71	99	69	93	68	27	27	
Los Angeles	Tejon Rancho	16	35	118.7	1425	107	71	103	70	99	68	27	24	2602
Los Angeles	Temple City	9	34.09	118.0	403	101	70	95	69	89	68	27	30	
Los Angeles	Termo	16	40.90	120.4	5300	95	60	92	59	87	57	37	-17	
Los Angeles	Torrance	6	33.79	118.3	110	93	69	86	68	80	66	18	32	1859
Los Angeles	Tujunga	9	34.29	118.2	1820	103	70	99	69	94	67	36	20	
Los Angeles	UCLA	9	34.09		430	93	69	86	68	80	66	20	39	1509
Los Angeles	Valinda	9	34	117.9	340	102	70	98	69	92	68	28	31	
Los Angeles	Valyermo RS	14	34.5	117.8	3600	100	67	96	66	91	65	41	12	3870
Los Angeles	Van Nuys	9	34.2	118.4	708	103	71	98	69	92	67	30	28	
Los Angeles	View Park	6, 8	34	118.3	300	95	69	88	68	78	66	18	36	
Los Angeles	Vincent	14	34.5	118.1	3135	105	67	101	65	96	64	33	10	
Los Angeles	Walnut	9	34	117.8	550	101	70	97	69	92	69	30	28	
Los Angeles	Walnut Park	8	33.9	118.2	45	92	69	84	68	78	66	12	37	
Los Angeles	West Athens	8	33.9		25	92	69	85	68	80	66	18	32	
Los Angeles	West Carson	6	33.79		100	92	69	87	68	81	66	18	32	
Los Angeles	West Compton	8	33.9		71	97	69	90	68	83	67	21	33	
Los Angeles	West Covina	9	34	117.9	365	102	70	98	69	92	68	34	29	
Los Angeles	West Hollywood	9	34	118.3	290	95	70	89	69	82	67	20	38	
Los Angeles	West Puente Valley	9	34	117.9	500	101	71	97	70	91	68	26	31	
Los Angeles	West Whittier-Los	9	34	118.0	320	99	69	90	68	84	67	24	31	
Los Angeles	Westlake Village	9	34.2	118.8	750	103	71	99	70	94	69	26	26	
Los Angeles	Westmont	8	33.9		110	96	70	89	69	83	67	20	36	
Los Angeles	Whittier	9	34	118.0	320	99	69	90	68	84	67	24	31	
Los Angeles	Willow Brook	8	33.90	118.2	60	97	70	90	69	83	67	21	35	
Los Angeles	Woodland Hills	9	34.2	118.6	944	104	71	99	70	93	68	32	26	
Madera	Bonita	13	32.70	117.0	105	91	69	82	67	78	64	20	28	1864
Madera	Chowchilla	13	37	120.2	200	104	72	101	70	96	68	38	22	
Madera	Madera	13	37	120.0	268	105	72	101	70	96	68	40	24	2673
Madera	Madera Acres	13	36.9		275	105	72	101	70	96	68	40	24	
Madera	North Fork RS	16	37.20	119.5	2630	98	66	95	65	92	62	36	15	
Marin	Corte Madera	2	37.90	122.5	55	97	68	91	66	84	64	34	28	
Marin	Fairfax	2	38	122.5	110	96	68	90	66	83	63	34	26	
Marin	Fort Baker	3	37.79	122.4	15	87	66	81	65	73	65	12	33	3080
Marin	Hamilton AFB	2	38.09	122.5	3	95	69	88	67	81	65	28	27	3311
Marin	Kentfield	2	38	122.5	120	97	66	91	65	84	63	35	27	3009
Marin	Larkspur	2	37.90	122.5	20	97	68	91	66	84	64	34	28	
Marin	Mill Valley	3	37.90	122.5	80	97	68	91	66	84	64	28	28	3400
Marin	Novato	2	38.09	122.5	370	94	64	87	63	80	61	30	25	
Marin	San Anselmo	2	38	122.0	50	95	67	89	66	82	65	32	26	
Marin	San Rafael	2	38	122.5	40	96	67	90	65	83	63	29	30	2440
Marin	Tamalpais-Homestead Valley	3	37.9		25	97	68	91	66	84	64	28	28	
Marin	Tiburon	3	37.90	122.4	90	85	66	80	65	73	63	12	30	
Mariposa	Catheys Valley	12	37.40	120.0	1000	102	69	99	68	94	67	38	21	
Mariposa	Dudleys	12	37.70	120.1	3000	97	65	94	64	90	62	44	10	4959
Mariposa	Yosemite Park Hq	16	37.70		3970	97	63	94	62	90	60	38	11	4785
Mendocino	Covelo	2	39.79	123.2	1385	99	67	93	65	87	63	43	15	4179
Mendocino	Fort Bragg	1	39.5	123.8	80	75	60	67	59	62	58	15	29	4424
Mendocino	Point Arena	1	38.90	123.7	100	76	62	72	60	67	58	19	29	4747

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Mendocino	Potter Valley PH	2	39.40	123.1	1015	101	68	96	67	89	65	40	20	3276
Mendocino	Ukiah	2	39.20	123.2	623	100	70	97	69	92	68	42	22	2958
Mendocino	Willits	2	39.40	123.3	1350	95	66	89	65	82	62	38	18	
Merced	Atwater	12	37.29	120.6	150	102	72	99	70	94	67	38	24	
Merced	Castle AFB	12	37.40	120.5	188	105	71	101	70	96	69	33	24	2590
Merced	Le Grand	12	37.20	120.2	255	101	70	96	68	91	66	38	23	2696
Merced	Livingston	12	37.3	120.7	165	103	72	100	70	95	68	39	24	
Merced	Los Banos	12	37	120.8	120	100	70	96	68	88	67	42	22	2616
Merced	Los Banos Res	12	37	120.8	407	101	70	97	68	89	67	42	23	
Merced	Merced AP	12	37.29	120.5	153	103	71	100	69	95	67	36	21	2653
Merced	San Luis Dam	12	37.09	121.0	277	97	68	91	66	86	64	32	25	
Merced	Volta PH	12	40.5	120.9	2220	101	66	98	65	93	63	33	21	
Merced	Winton	12	37.4	120.6	168	103	71	100	69	95	67	36	21	
Modoc	Adin RS	16	41.20	120.9	4195	96	61	92	60	88	59	43	-7	
Modoc	Alturas RS	16	41.5	120.5	4400	99	62	96	61	91	59	43	-10	6895
Modoc	Cedarville	16	41.5	120.1	4670	97	61	94	60	89	58	35	1	6304
Modoc	Fort Bidwell	16	41.90	120.1	4498	93	60	90	59	85	57	38	-2	6381
Modoc	Jess Valley	16	41.29	120.3	5300	92	59	89	58	84	56	35	-7	7045
Mono	Bodie	16	38.20	119.0	8370	83	50	80	49	76	48	42	-21	
Mono	Bridgeport	16	38.20	119.2	6470	89	56	86	54	82	53	41	-20	
Mono	Mono Lake	16	38	119.1	6450	91	58	88	57	84	55	32	4	6518
Mono	Twin Lakes	16	38.70	119.0	7829	73	49	64	47	57	46	30	-7	9196
Mono	White Mtn 1	16	37.5		1015	73	49	69	47	65	45	37	-15	
Mono	White Mtn 2	16	37.59		1247	61	42	58	41	54	40	38	-20	
Monterey	Camp Roberts	4	35.79	120.7	765	106	72	101	71	95	69	45	16	2890
Monterey	Carmel Valley	3	36.5	121.7	425	94	68	88	66	80	65	20	25	
Monterey	Carmel-by-the-Sea	3	36.5	121.9	20	87	65	78	62	71	61	20	30	
Monterey	Castroville	3	36.8	121.7	20	86	66	77	63	70	61	18	32	
Monterey	Fort Ord	3	36.70	121.7	134	86	65	77	63	70	60	18	24	3818
Monterey	Greenfield	4	36.2	121.2	287	92	67	88	65	84	64	32	22	
Monterey	King City	4	36.20	121.1	320	94	67	90	65	85	64	36	20	2639
Monterey	Marina	3	36.70	121.8	20	86	66	77	63	70	61	18	32	
Monterey	Monterey AP	3	36.59	121.8	245	86	65	77	62	70	61	20	30	3556
Monterey	Monterey CO	3	36.59	121.8	345	87	65	78	62	71	61	20	32	3169
Monterey	Pacific Grove	3	36.70	122.0	114	87	66	78	63	71	61	19	31	
Monterey	Priest Valley	4	36.20	120.7	2300	97	66	93	65	88	63	34	13	4144
Monterey	Prunedale	3	36.6	121.6	260	86	66	83	65	79	62	20	26	
Monterey	Salinas 3 E	3	36.70	121.6	85	86	66	83	65	79	62	20	26	
Monterey	Salinas AP	3	36.70	121.6	69	85	67	82	65	78	62	20	28	2959
Monterey	San Antonio Mission	4	36	117.6	1060	99	69	94	68	88	67	28	19	
Monterey	Seaside	4	36.59	122.8	17	85	66	79	64	73	62	20	30	
Monterey	Soledad	3	36.4	121.3	200	90	67	87	65	82	64	23	24	
Napa	American Canyon	2	37.6	122.2	85	93	67	90	66	84	64	23	28	
Napa	Angwin	2	38.59	122.4	1815	98	66	93	64	88	62	33	25	
Napa	Berryessa Lake	2	38.59	122.0	480	102	70	98	69	92	67	35	26	
Napa	Duttons Landing	2	38.2	122.3	20	96	68	91	66	84	64	31	26	
Napa	Markley Cove	2	38.5	122.1	480	104	70	99	69	93	67	39	23	
Napa	Napa State Hospital	2	37.29	122.2	60	94	67	91	67	86	66	29	26	2749
Napa	Saint Helena	2	38.5	122.4	225	102	70	98	69	93	67	40	22	2878
Nevada	Boca	16	39.40	120.1	5575	92	58	89	57	84	55	46	-18	8340
Nevada	Deer Creek PH	16	39.29	120.8	4455	93	61	91	60	87	58	39	10	5863

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Nevada	Grass Valley	11	39.20	121.0	2400	99	67	96	65	91	63	29	19	
Nevada	Lake Spaulding	16	39.29	120.6	5156	89	58	86	57	83	55	34	3	6447
Nevada	Nevada City	11	39.29	121.0	2600	97	66	94	64	88	63	41	14	4900
Nevada	Truckee RS	16	39.29	120.1	5995	90	58	87	57	82	55	40	-10	8230
Nevada/Placer	Donner Mem Stt Pk	16	39.29	120.2	5937	85	56	82	56	77	54	40	-3	
Orange	Aliso Viejo	8	33.6	117.7	50	91	69	83	68	76	66	18	30	
Orange	Anaheim	8	33.79	117.9	158	99	69	92	68	85	67	26	32	
Orange	Brea Dam	8	33.90	117.9	275	100	69	94	68	86	66	29	30	
Orange	Buena Park	8	33.90	118.0	75	98	69	92	68	85	67	25	31	
Orange	Costa Mesa	6	33.70	117.8	100	88	68	81	66	73	65	16	31	1482
Orange	Cypress	8	33.79	118.0	75	98	70	92	69	85	67	24	31	
Orange	Dana Point	6	33.5	117.7	100	91	69	84	68	78	66	13	30	
Orange	El Toro MCAS	8	33.70	117.7	380	96	69	89	69	82	68	26	34	1591
Orange	El Toro Station	8	33.7		380	96	69	89	69	82	68	26	34	
Orange	Fountain Valley	6	33.70	117.9	60	97	70	90	68	84	67	18	33	
Orange	Fullerton	8	33.90	117.9	340	100	70	94	69	87	68	26	30	
Orange	Garden Grove	8	33.59	117.9	85	98	70	91	68	84	67	23	31	
Orange	Huntington Beach	6	33.70	117.8	40	91	69	83	67	76	66	14	34	
Orange	Irvine	8	33.70	118.0	50	96	69	88	68	82	67	27	33	
Orange	John Wayne AP	6	33.59		115	98	70	91	68	84	67	26	33	1496
Orange	La Habra	9	33.90	118.0	305	100	69	94	68	87	67	27	30	
Orange	La Palma	8	33.90	118.0	75	98	69	92	68	85	67	25	31	
Orange	Laguna Beach	6	33.5	117.7	35	91	69	83	68	76	66	18	30	2222
Orange	Laguna Niguel	6	33.6	117.7	500	95	67	87	66	81	63	22	33	
Orange	Los Alamitos NAS	8	33.79	118.0	30	98	71	89	69	83	68	23	32	1740
Orange	Mission Viejo	8	33.59	118.0	350	95	67	87	66	81	63	22	33	
Orange	Newport Beach	6	33.59	117.8	10	87	68	80	66	72	65	12	34	1952
Orange	Orange	8	33.59	118.0	194	99	70	92	68	85	67	27	33	
Orange	Placentia	8	33.90	118.0	323	101	69	93	68	87	67	28	30	
Orange	Rancho Santa	8	33.6		116	95	67	87	66	81	63	22	33	
Orange	Rossmoor	8	33.79	118.0	20	92	67	85	64	79	62	19	32	
Orange	San Clemente	6	33.40	118.5	208	91	68	85	67	80	66	12	31	
Orange	Santa Ana FS	8	33.79	117.8	115	98	70	91	68	84	67	26	33	1430
Orange	Seal Beach	6	33.79	118.0	21	94	69	86	68	80	65	15	35	1519
Orange	South Laguna	6	33.6	117.7	100	91	69	83	68	78	66	18	30	
Orange	Stanton	8	33.59	117.9	45	98	69	91	68	84	67	24	31	
Orange	Tustin Foothills	8	33.8		500	99	71	92	69	85	68	27	28	
Orange	Tustin Irvine Rch	8	33.70	117.7	118	99	71	92	69	85	68	27	28	1856
Orange	Villa Park	8	33.8	117.8	300	99	70	92	68	85	67	27	33	
Orange	Westminster	6	33.79	118.0	38	95	70	88	68	81	67	23	33	
Orange	Yorba Linda	8	33.90	117.8	350	102	70	94	69	88	68	31	30	1643
Placer	Auburn	11	38.90	121.0	1292	103	69	100	67	95	66	33	25	3089
Placer	Blue Canyon AP	16	39.29	120.7	5280	88	60	85	59	81	57	20	13	5704
Placer	Bowman Dam	11	39.40	120.6	5347	89	59	86	57	82	55	26	9	5964
Placer	Colfax	11	39.09	120.9	2418	100	66	97	65	92	63	29	22	3424
Placer	Donner Summit	16	39.40	120.3	7239	80	53	77	53	72	50	40	-8	8290
Placer	Loomis	11	38.8	121.1	408	107	71	103	70	98	69	39	21	
Placer	North Auburn	11	38.9		1300	103	69	100	67	95	66	33	25	
Placer	Rocklin	11	38.79	121.2	239	108	72	104	70	99	69	39	20	3143
Placer	Roseville	11	38.70	121.2	160	105	71	102	70	96	68	36	24	
Placer	Squaw Valley	16	39.20	120.1	6235	88	57	85	56	80	54	40	-10	

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Placer	Tahoe City	16	39.20	120.1	6230	84	56	81	55	76	53	36	2	8085
Placer	Tahoe Valley AP	16	38.90		6254	85	56	82	55	77	53	38	-5	
Plumas	Canyon Dam	16	40.09	121.0	4555	93	60	90	59	85	57	39	1	6834
Plumas	Chester	16	40.29	121.2	4525	94	62	91	61	86	59	33	-3	
Plumas	Portola	16	39.79	120.4	4850	92	63	89	61	84	59	48	-9	7111
Plumas	Quincy	16	39.90	120.9	3409	101	64	98	63	93	62	45	1	5763
Plumas	Turntable Creek	16	40.79		1067	105	69	101	68	95	66	28	24	
Riverside	Banning	15	33.90	116.8	2349	104	69	100	68	96	67	34	20	
Riverside	Beaumont	10	33.90	116.9	2605	103	68	99	67	95	66	38	22	2628
Riverside	Blythe AP	15	33.59	114.7	395	115	74	112	73	108	71	27	28	1219
Riverside	Blythe CO	15	33.59	114.6	268	115	74	112	73	108	71	27	24	1312
Riverside	Canyon Lake	10	33.8	117.2	1500	105	70	101	69	97	68	39	22	
Riverside	Cathedral City	15	33.8	116.4	400	117	74	113	73	109	72	33	26	
Riverside	Coachella	15	33.70	116.1	-76	114	74	110	73	106	73	28	25	
Riverside	Corona	10	33.90	117.5	710	104	70	100	69	92	67	35	26	1794
Riverside	Desert Hot Springs	15	34	116.5	1060	115	73	111	72	107	71	35	24	
Riverside	Eagle Mtn	14	33.79	115.4	973	113	72	110	71	105	69	24	32	1138
Riverside	East Hemet	10	33.7		1655	109	70	104	69	101	67	40	20	
Riverside	Elsinore	10	33.70	117.3	1285	105	71	101	70	98	69	39	22	2128
Riverside	Glen Avon	10	34	117.4	827	105	70	101	69	95	67	35	28	
Riverside	Hayfield Pumps	14	33.70	115.6	1370	112	71	108	70	104	68	31	24	1529
Riverside	Hemet	10	33.70	116.9	1655	109	70	104	69	101	67	40	20	
Riverside	Home Gardens	10	33.9	117.5	678	104	70	100	69	92	67	35	26	
Riverside	Idyllwild	16	33.70	116.7	5397	93	62	89	61	84	60	35	9	
Riverside	Indio	15	33.70	116.2	11	115	75	112	75	107	74	30	24	1059
Riverside	La Quinta	15	33.8	116.3	400	116	74	112	73	108	72	34	26	
Riverside	Lake Elsinore	10	33.7	117.3	1233	105	70	101	69	97	68	39	22	
Riverside	Lakeland Village	10	33.6	117.3	1233	105	70	101	69	97	68	39	12	
Riverside	March AFB	10	33.90	117.2	1511	103	70	99	68	94	65	34	23	2089
Riverside	Mecca FS	15	33.59	116.0	-180	115	75	111	75	107	74	30	24	1185
Riverside	Mira Loma	10	34	117.5	700	105	70	101	69	95	66	34	25	
Riverside	Moreno Valley	10	33.9	117.2	1600	103	70	99	68	94	65	34	27	
Riverside	Mount San Jacinto	16	33.79	116.6	8417	82	56	77	55	73	53	35	-1	
Riverside	Norco	10	33.90	117.0	700	103	70	99	69	94	67	34	27	
Riverside	Palm Desert	15	33.70	116.5	200	116	74	112	73	108	72	34	26	
Riverside	Palm Desert Country	15	33.7		243	116	74	112	73	108	72	34	26	
Riverside	Palm Springs	15	33.79	116.5	411	117	74	113	73	109	72	35	26	1109
Riverside	Pedley	10	34	117.4	718	105	70	101	69	95	66	34	26	
Riverside	Perris	10	33.79	117.2	1470	105	70	101	69	97	68	39	22	
Riverside	Rancho Mirage	15	33.8	116.4	248	117	74	113	73	109	72	33	26	
Riverside	Riverside Exp Sta	10	34	117.3	986	106	71	102	69	97	67	36	29	
Riverside	Riverside FS 3	10	34	117.3	840	104	70	100	69	95	65	37	27	1818
Riverside	Rubidoux	10	34	117.0	792	106	71	102	70	97	68	36	27	
Riverside	San Jacinto	10	33.79	116.9	1535	110	70	105	69	102	68	41	20	2376
Riverside	Sun City	10	33.7	117.2	1420	105	70	101	69	97	68	39	22	
Riverside	Temecula	10	33.5	117.1	1006	101	69	96	68	91	67	34	24	
Riverside	Thermal AP	15	33.59	116.1	-112	114	74	110	74	106	74	29	26	1154
Riverside	Valle Vista	10	33.8	116.8	1655	109	70	104	69	101	67	40	20	
Riverside	Woodcrest	10	33.9	117.3	1500	104	70	100	69	95	65	37	27	
Riversie	Wildomar	10	33.6	117.2	1255	103	70	99	69	94	68	36	23	
Sacramento	Arden	12	38.5		80	104	70	100	69	94	67	35	28	

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Sacramento	Brannan Island	12	38.09	121.7	30	100	69	95	68	89	67	10	24	
Sacramento	Carmichael	12	38.59	121.4	100	104	70	100	69	94	68	35	25	
Sacramento	Citrus Heights	12	38.70	121.4	138	104	71	100	70	94	68	36	24	
Sacramento	Elk Grove	12	38.4	121.3	50	104	71	100	69	94	68	35	29	
Sacramento	Fair Oaks	12	38.70	121.2	50	104	70	100	69	94	69	36	23	
Sacramento	Florin	12	38.5	121.4	100	104	71	100	69	94	68	35	29	
Sacramento	Folsom Dam	12	38.70	121.1	350	104	70	101	69	95	67	36	25	
Sacramento	Foothill Farms	12	38.6	121.3	90	104	71	100	70	94	68	36	24	
Sacramento	Galt	12	38.2	121.3	40	101	70	97	68	91	67	38	23	
Sacramento	La Riviera	12	38.6		190	104	71	100	70	94	68	32	30	
Sacramento	Mather AFB	12	38.59	121.3	96	104	71	100	70	94	68	35	28	
Sacramento	McClellan AFB	12	38.70	121.4	86	105	71	102	70	96	68	35	23	2566
Sacramento	North Highlands	12	38.59	121.4	45	104	71	100	69	94	67	35	23	2566
Sacramento	Orangevale	12	38.70	121.2	140	105	72	102	70	96	68	36	24	
Sacramento	Parkway-South	12	38.5		17	104	71	100	70	94	68	32	30	
Sacramento	Rancho Cordova	12	38.59	121.3	190	104	72	100	69	94	68	35	26	
Sacramento	Rio Linda	12	38.6	121.4	86	104	72	100	70	94	68	32	28	
Sacramento	Rosemont	12	38.3	121.3	190	104	71	100	70	94	68	32	30	
Sacramento	Sacramento AP	12	38.5	121.5	17	104	72	100	70	94	68	35	26	2843
Sacramento	Sacramento CO	12	38.59	121.5	84	104	71	100	70	94	68	32	30	
Sacramento	Walnut Grove	12	38.20	121.5	23	102	70	98	69	92	68	37	24	
San Benito	Hollister	4	36.90	121.4	280	96	68	89	67	81	65	30	21	2725
San Benito	Idria	4	36.40	120.6	2650	97	66	92	65	87	62	27	24	3128
San Berardino	Mitchell Caverns	14	34.90		4350	102	64	98	63	94	61	29	21	
San Bernadino	Redlands	10	34.09	117.1	1318	106	70	102	69	98	67	34	27	1993
San Bernardino	Adelanto	14	34.6	117.4	2865	105	67	101	65	97	62	39	14	
San Bernardino	Apple Valley	14	34.5	117.1	2935	105	66	101	65	97	64	38	14	
San Bernardino	Baker	14	35.29	116.1	940	115	73	112	72	108	70	29	23	
San Bernardino	Balch PH	14	36.90		1720	100	67	97	66	93	64	26	26	
San Bernardino	Barstow	14	34.90	117.0	2162	107	69	104	69	100	67	35	16	2580
San Bernardino	Big Bear Lake	16	34.20	116.8	6745	87	59	83	58	79	56	32	-3	6850
San Bernardino	Bloomington	10	34	117.4	980	106	71	102	70	98	69	34	30	
San Bernardino	Chino	10	34	117.6	714	104	70	100	69	94	68	35	27	
San Bernardino	Chino Hills	10	34.1	117.7	800	104	70	100	69	94	68	35	27	
San Bernardino	Colton	10	34.09	117.3	978	105	70	102	68	97	67	35	28	
San Bernardino	Crestline	16	34.2	117.2	4900	90	62	86	61	81	59	26	13	
San Bernardino	Cucamonga	10	34.09	117.6	1450	103	69	99	68	93	65	31	29	
San Bernardino	Daggett AP	14	34.90	116.7	1915	109	68	106	68	102	66	33	21	2203
San Bernardino	El Mirage	14	34.59	117.6	2910	105	69	101	68	97	66	31	9	
San Bernardino	Fontana	10	34.09	117.4	1090	105	70	101	69	97	67	33	30	1530
San Bernardino	George AFB	14	34.59	117.3	2875	105	67	102	65	98	62	31	19	2887
San Bernardino	Grand Terrace	10	34.1	117.3	1000	105	70	102	68	97	67	35	28	
San Bernardino	Hesperia	14	34.4	117.3	3191	105	67	101	65	97	63	38	14	
San Bernardino	Highland	10	34.09	117.2	1315	106	70	102	69	97	68	36	26	
San Bernardino	Lake Arrowhead	16	34.2	117.1	5205	90	62	86	61	81	59	26	13	5310
San Bernardino	Loma Linda	10	34	117.5	1150	106	70	103	69	99	67	36	27	
San Bernardino	Los Serranos	10	34.1	117.7	714	104	70	100	69	94	68	35	27	
San Bernardino	Lucerne Valley	14	34.5	116.9	2957	105	67	101	66	98	64	38	12	
San Bernardino	Mentone	10	34.1	117.1	1700	106	70	102	69	98	67	34	27	
San Bernardino	Montclair	10	34	117.0	1220	104	69	100	68	94	66	35	28	
San Bernardino	Mount Baldy Notch	16	34.29	117.6	7735	80	58	76	57	71	54	32	4	

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San Bernardino	Mountain Pass	14	35.5	115.5	4730	100	65	96	64	92	63	29	11	
San Bernardino	Muscoy	10	34.2	117.3	1400	105	71	101	69	96	66	37	26	
San Bernardino	Needles AP	15	34.79	114.6	913	117	73	114	72	110	71	26	27	1391
San Bernardino	Ontario AP	10	34	117.0	934	105	70	101	69	95	66	34	26	1710
San Bernardino	Parker Res	15	34.29	114.1	738	115	74	112	73	108	72	26	32	1223
San Bernardino	Pinnacles NM	14	36.5	121.1	1307	98	68	94	67	89	64	45	20	2956
San Bernardino	Rialto	10	34.09	117.0	1254	105	70	101	69	96	66	35	28	
San Bernardino	San Bernardino	10	34.1	117.3	1125	106	70	102	69	98	68	39	27	1777
San Bernardino	Squirrel Inn	14	34.20	117.2	5680	86	61	82	60	77	58	23	12	5175
San Bernardino	Trona	14	35.79	117.3	1695	113	72	109	70	105	68	35	18	2415
San Bernardino	Twentynine Palms	14	34.09	116.0	1975	110	71	107	70	103	69	31	21	1973
San Bernardino	Upland	10	34.1	117.6	1605	102	69	98	68	92	66	31	29	2175
San Bernardino	Victorville Pumps	14	34.5		2858	105	67	101	65	97	62	39	14	3191
San Bernardino	Yucaipa	10	34	117.0	2600	106	68	102	67	98	65	35	27	
San Bernardino	Yucca Valley	14	34.2	116.4	2600	108	71	105	70	101	69	32	19	
San Bernardino/Kern	China Lake	14	35.70	117.6	2220	112	70	108	68	104	68	33	15	2560
San Diego	Alpine	10	32.79	116.7	1735	99	69	95	68	91	67	35	27	
San Diego	Barrett Dam	10	32.70	116.6	1623	103	69	97	68	92	67	35	22	2656
San Diego	Borrego Desert PK	15	33.20	116.4	805	112	76	107	74	101	72	36	25	
San Diego	Bostonia	10	32.8	116.9	600	96	70	91	69	81	67	30	29	
San Diego	Cabrillo NM	7	32.70	117.2	410	89	69	84	68	80	67	12	39	
San Diego	Camp Pendleton	10	33.4	117.3	50	88	69	85	68	80	67	12	34	
San Diego	Campo	14	32.59	116.4	2630	101	67	95	66	90	66	41	16	3303
San Diego	Cardiff-by-the-Sea	7	33	117.2	80	87	68	83	67	77	65	12	35	
San Diego	Carlsbad	7	33.20	117.3	44	87	68	83	67	77	65	10	34	
San Diego	Casa de Oro-Mount	10	32.7		530	96	71	88	69	84	67	19	34	
San Diego	Chula Vista	7	32.59	117.0	9	90	70	84	68	79	66	9	33	2072
San Diego	Coronado	7	32.70	117.1	20	89	69	82	67	76	65	10	36	1500
San Diego	Cuyamaca	7	33	116.5	4650	92	64	85	62	81	59	29	11	4848
San Diego	El Cajon	10	32.70	116.9	525	96	70	91	69	87	67	30	29	
San Diego	El Capitan Dam	14	32.90	116.8	600	105	71	98	70	93	68	35	29	1533
San Diego	Encinitas	7	33	117.2	50	87	68	83	67	77	65	10	35	
San Diego	Escondido	10	33.09	117.0	660	97	69	90	68	84	67	29	26	2005
San Diego	Fallbrook	10	33.59	117.2	660	94	68	89	67	85	66	29	26	2077
San Diego	Fort MacArthur	7	33.70	118.3	200	92	69	84	68	78	66	13	35	1819
San Diego	Grossmont	7	32.70	116.9	530	96	69	89	68	84	66	23	31	
San Diego	Henshaw Dam	10	33.20		2700	99	68	94	67	90	66	38	15	3708
San Diego	Imperial Beach	7	32.5	117.1	23	87	69	82	68	78	67	10	35	1839
San Diego	Julian Wynola	14	33.09	116.8	3650	96	66	91	64	87	62	39	20	4049
San Diego	La Mesa	7	32.79	117.0	530	94	70	88	69	84	67	23	34	1567
San Diego	Lakeside	10	32.79	117.0	690	95	69	90	68	86	66	20	26	
San Diego	Lemon Grove	7	32.70	117.2	437	96	71	88	69	84	67	19	34	
San Diego	Miramar AFS	7	32.90	117.1	477	97	69	91	68	86	67	22	32	1532
San Diego	National City	7	32.70	117.0	34	87	70	82	68	78	66	10	36	
San Diego	Oceanside	7	33.20	117.4	10	84	69	80	67	74	65	10	33	
San Diego	Otay-Castle Pk	7	32.59	117.0	500	87	68	81	66	74	63	10	33	
San Diego	Palomar Obsy	14	33.40	116.8	5545	90	62	85	61	80	59	22	16	4141
San Diego	Pendleton MCB	7	33.29	117.3	63	92	68	87	67	81	66	22	34	1532
San Diego	Pendleton MCB Coast	7	33.20	117.4	24	84	69	80	67	75	65	10	39	1782
San Diego	Poway Valley	10	33	117.0	500	100	70	94	69	89	68	26	29	
San Diego	Ramona Spaulding	10	33.09	116.8	1480	103	70	97	69	92	68	40	22	

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San Diego	Rancho Bernardo	10	33.02	117.0	500	96	69	91	68	85	67	26	29	
San Diego	Rancho San Diego	10	32.8		300	94	69	86	68	82	66	30	34	
San Diego	San Diego AP	7	32.70	117.1	13	88	70	83	69	78	68	13	38	1507
San Diego	San Marcos	10	33.1	117.1	567	97	69	98	68	84	67	29	26	
San Diego	Santee	10	32.79	116.9	400	96	69	91	68	87	67	20	25	
San Diego	Solana Beach	7	33	117.2	15	87	68	83	67	77	65	10	35	
San Diego	Spring Valley	10	32.70	117.0	300	94	69	86	68	82	66	30	34	
San Diego	Vista	7	33.20	117.2	510	96	69	90	68	85	67	16	30	
San Diego	Warner Springs	14	33.29	116.6	3180	100	67	95	66	91	65	40	15	3591
San Francisco	San Francisco AP	3	37.59	122.3	8	89	66	83	64	74	61	20	31	3042
San Francisco	San Francisco CO	3	37.79	122.4	52	84	65	79	63	71	60	14	38	3080
San Joaquin	Calaveras Big Trees	12	38.29	120.3	4696	92	61	88	60	84	58	33	11	5848
San Joaquin	Country Club	12	37.8		600	102	69	97	68	92	66	30	68	
San Joaquin	Garden Acres	12	38		20	103	71	98	69	93	67	35	24	
San Joaquin	Lathrop	12	37.8	121.2	22	103	71	98	69	93	67	35	24	
San Joaquin	Lincoln Village	12	38	121.3	12	101	70	96	68	91	67	37	24	
San Joaquin	Lodi	12	38.09	121.2	40	101	70	97	68	91	67	38	23	2859
San Joaquin	Manteca	12	37.79	121.2	34	102	70	97	68	91	67	37	24	
San Joaquin	Ripon	12	37.7	121.1	61	102	70	97	68	91	67	37	23	
San Joaquin	Stockton AP	12	37.90	121.2	22	103	71	98	69	93	67	35	24	2806
San Joaquin	Stockton FS 4	12	38	121.3	12	101	70	96	68	91	67	37	24	2846
San Joaquin	Tracy Carbona	12	37.70		140	102	70	97	68	90	67	38	24	2704
San Joaquin	Tracy Pumps	12	37.79		61	104	71	99	69	92	68	39	23	
San Luis Obispo	Arroyo Grande	5	35.09	120.5	105	92	66	86	64	79	62	18	28	
San Luis Obispo	Atascadero	4	35.5	120.7	837	94	66	89	67	84	65	42	25	
San Luis Obispo	Baywood-Los Osos	5	35.3		100	88	65	82	64	76	62	14	31	
San Luis Obispo	Cambria AFS	5	35.5	121.0	690	78	62	72	61	66	59	16	30	3646
San Luis Obispo	El Paso de Robles	4	35.6		721	102	65	95	65	90	65	44	16	
San Luis Obispo	Grover City	5	35.09		100	93	69	86	64	80	62	18	30	
San Luis Obispo	Morro Bay FD	5	35.40	120.8	115	88	65	82	64	76	62	14	31	
San Luis Obispo	Nacimiento Dam	4	35.79	120.8	770	100	68	94	66	88	64	35	22	
San Luis Obispo	Nipomo	5	35	120.4	330	90	66	83	64	78	61	23	25	
San Luis Obispo	Oceano	5	35.1	120.6	20	93	69	86	64	80	62	18	30	
San Luis Obispo	Paso Robles AP	4	35.70	120.6	815	104	66	97	66	92	65	40	19	2973
San Luis Obispo	Paso Robles CO	4	35.59	120.6	700	102	65	95	65	90	65	44	16	2885
San Luis Obispo	Pismo Beach	5	35.09	120.6	80	92	66	85	64	80	62	16	30	2756
San Luis Obispo	Point Piedras Blancas	5	35.70	121.2	59	73	60	67	59	61	57	10	36	3841
San Luis Obispo	San Luis Obispo	5	35.29	120.7	320	94	63	87	63	81	62	26	30	2498
San Luis Obispo	Twitchell Dam	5	35	120.3	582	99	70	93	68	88	66	26	26	
San Mateo	Atherton	3	37.5	122.2	50	90	66	84	64	78	62	27	23	
San Mateo	Belmont	3	37.5	122.2	33	90	66	84	64	78	62	24	29	
San Mateo	Burlingame	3	37.59	122.3	10	88	67	82	64	76	63	20	30	
San Mateo	Daly City	3	37.59	122.5	410	84	65	78	62	73	61	16	34	
San Mateo	East Palo Alto	3	37.5	122.1	25	93	66	85	64	77	62	25	26	
San Mateo	Foster City	3	37.5	122.7	20	92	67	84	65	76	63	22	29	
San Mateo	Half Moon Bay	3	37.5	122.4	60	83	64	76	62	69	59	15	32	3843
San Mateo	Hillsborough	3	37.59	122.3	352	90	66	82	65	74	64	23	30	
San Mateo	Menlo Park	3	37.40	122.3	65	94	67	86	65	78	63	25	27	
San Mateo	Millbrae	3	37.59	122.3	10	90	66	82	63	74	61	24	30	
San Mateo	Pacifica	3	37.59	122.0	13	87	65	79	62	71	60	16	31	
San Mateo	Redwood City	3	37.5	122.2	31	90	67	86	66	81	64	28	28	2599

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San Mateo	San Bruno	3	37.7	122.4	20	86	66	80	64	73	62	23	30	3042
San Mateo	San Carlos	3	37.5	122.2	26	92	67	88	65	82	63	28	28	
San Mateo	San Gregorio 2 SE	3	37.29		275	87	66	81	63	74	61	30	27	
San Mateo	San Mateo	3	37.5	122.3	21	92	67	84	65	76	63	24	31	2655
San Mateo	South San Francisco	3	37.70	122.4	10	87	67	81	64	72	62	20	32	
San Mateo	Woodside	3	37.5	122.2	75	92	67	84	66	76	63	24	22	
Santa Barbara	Cachuma Lake	5	34.59	119.9	781	97	69	92	67	87	65	19	26	
Santa Barbara	Carpinteria	6	34.40	119.5	385	90	69	83	67	77	65	15	30	
Santa Barbara	Cuyama	4	34.90	116.5	2255	99	68	96	67	89	66	42	13	
Santa Barbara	Guadalupe	5	35	120.5	85	92	66	86	64	79	62	18	28	
Santa Barbara	Isla Vista	6	34.5	119.8	40	90	69	83	67	77	65	20	33	
Santa Barbara	Lompoc	5	34.90	120.4	95	84	63	77	62	72	60	18	26	2888
Santa Barbara	Point Arguello	5	34.59	120.6	76	75	64	71	63	65	59	17	29	3826
Santa Barbara	Santa Barbara AP	6	34.40	119.8	9	90	69	83	67	77	65	20	29	2487
Santa Barbara	Santa Barbara CO	6	34.40	119.6	5	91	69	84	67	78	65	22	33	1994
Santa Barbara	Santa Maria AP	5	34.90	120.4	236	90	66	83	64	78	61	23	25	3053
Santa Barbara	Vandenburg AFB	5	34.70	122.8	368	85	62	77	61	71	60	16	30	3451
Santa Clara	Almaden AFS	3	37.20	121.9	3470	95	62	90	60	85	59	20	20	4468
Santa Clara	Alum Rock	4	37.40	121.8	70	95	68	90	66	84	64	22	28	
Santa Clara	Campbell	4	37.29	121.8	195	93	69	88	66	83	65	30	28	
Santa Clara	Cupertino	4	37.29	122.0	70	96	68	88	67	80	64	30	28	
Santa Clara	Gilroy	4	37	121.5	194	101	70	93	68	86	65	25	23	
Santa Clara	Los Altos	4	37.29	122.0	163	96	68	88	65	80	62	26	28	
Santa Clara	Los Altos Hills	4	37.3	122.1	183	93	67	85	64	77	63	25	28	
Santa Clara	Los Gatos	4	37.20	121.9	365	98	69	90	67	82	66	32	26	2741
Santa Clara	Milpitas	4	37.40	121.9	15	94	68	87	65	79	63	27	27	
Santa Clara	Moffett Field NAS	4	37.40	122.0	39	89	68	84	66	78	64	23	30	2511
Santa Clara	Morgan Hill	4	37.09	120.0	350	100	69	92	68	85	66	25	26	
Santa Clara	Mount Hamilton	4	37.29	121.6	4206	95	59	88	58	81	56	18	18	4724
Santa Clara	Mountain View	4	37.5	121.9	95	93	67	85	64	77	62	25	28	
Santa Clara	Palo Alto	4	37.5	122.1	25	93	66	85	64	77	62	25	26	2891
Santa Clara	San Jose	4	37.40	121.9	67	94	68	86	66	78	64	26	29	2438
Santa Clara	Santa Clara Univ	4	37.40	121.9	88	90	67	87	65	82	63	30	29	2566
Santa Clara	Saratoga	4	37.29	122.0	500	96	67	88	66	80	65	31	27	
Santa Clara	Stanford	4	37.5		23	93	66	85	64	77	62	25	26	
Santa Clara	Sunnyvale	4	37.29	122.0	97	96	68	88	66	80	64	26	29	2511
Santa Cruz	Aptos	3	37	121.9	500	94	67	88	66	83	63	30	27	
Santa Cruz	Ben Lomond	3	37.09	122.1	450	92	67	85	66	79	63	30	25	
Santa Cruz	Boulder Creek	3	37.2	122.1	493	92	67	85	65	79	63	30	25	
Santa Cruz	Capitola	3	37	121.9	64	94	67	88	66	81	63	24	27	
Santa Cruz	Felton	3	37	122.0	100	94	68	88	66	81	64	28	27	
Santa Cruz	Freedom	3	37	121.7	1495	89	67	85	64	79	62	22	27	
Santa Cruz	Opal Cliffs	3	37	121.9	125	94	68	88	66	81	64	28	27	
Santa Cruz	Rio Del Mar	3	37	121.9	50	94	67	88	66	83	63	30	27	
Santa Cruz	Santa Cruz	3	37	122.0	125	94	68	88	66	81	64	28	27	3136
Santa Cruz	Scotts Valley	3	37	122.0	400	94	68	88	66	81	64	28	27	
Santa Cruz	Soquel	3	37	121.9	50	94	67	88	66	81	63	24	27	
Santa Cruz	Watsonville	3	36.90	121.7	95	86	66	82	64	79	61	22	28	3418
Shasta	Anderson	11	40.5	122.2	430	107	71	103	70	97	68	30	26	
Shasta	Burney	16	40.90	121.6	3127	95	64	92	63	88	61	42	0	6404
Shasta	Enterprise	11	40.59	122.3	470	107	69	103	68	97	67	29	26	

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Shasta	Hat Creek PH 1	16	40.90	121.5	3015	99	65	96	64	91	62	48	2	5689
Shasta	Iron Mtn	11	34.09	115.1	922	116	75	112	74	108	73	26	29	1251
Shasta	Manzanita Lake	16	40.5	121.5	5850	87	58	84	57	79	55	34	-3	7617
Shasta	Platina	11	40.40	122.8	2260	96	65	92	64	87	61	36	13	
Shasta	Redding FS 4	11	40.59	122.4	470	107	69	103	68	97	67	30	26	2544
Shasta	Shasta Dam	16	40.70	122.4	1076	105	69	101	68	95	67	27	29	2943
Shasta	Whiskeytown Res	11	40.59	122.5	1295	105	69	101	68	96	67	31	25	
Sierra	Downieville RS	16	39.59	120.8	2895	98	64	95	63	90	61	42	13	
Sierra	Sierra City	16	39.59	120.1	4230	96	62	93	61	89	59	43	12	
Sierra	Sierraville RS	16	39.59	120.3	4975	94	60	91	59	86	57	44	-10	6893
Siskiyou	Callahan	16	41.29	122.8	3185	97	63	93	62	88	60	35	7	
Siskiyou	Cecilville	16	41.09	123.1	3000	95	63	89	62	84	59	44	13	
Siskiyou	Fort Jones RS	16	41.59	122.8	2725	98	64	93	63	88	61	44	5	5590
Siskiyou	Happy Camp RS	16	41.79	123.3	1150	103	67	97	66	92	65	41	18	4263
Siskiyou	Hilt	16	42	122.6	2900	97	64	93	62	89	60	39	5	
Siskiyou	Lava Beds	16	41.70	121.5	4770	93	59	89	58	84	56	41	-1	
Siskiyou	McCloud	16	41.29	122.1	3300	96	63	93	62	87	60	42	5	5990
Siskiyou	Montague	16	41.79	122.4	2648	99	66	95	65	90	63	39	3	5474
Siskiyou	Mount Hebron RS	16	41.79	122.0	4250	92	60	88	59	82	57	42	-10	
Siskiyou	Mount Shasta	16	41.29	122.3	3535	93	62	89	61	84	59	34	8	5890
Siskiyou	Sawyer's Bar RS	16	41.29		2169	100	66	95	65	88	62	38	14	4102
Siskiyou	Tulelake	16	42	121.4	4035	92	60	88	59	83	57	41	-5	6854
Siskiyou	Weed FD	16	41.40	122.3	3590	92	63	89	62	84	59	35	4	
Siskiyou	Yreka	16	41.70	122.6	2625	99	66	95	65	90	64	39	8	5395
Solano	Benicia	12	38.09	122.1	55	99	69	93	67	87	65	30	28	
Solano	Dixon	12	38.40	121.8	100	104	72	99	70	93	68	36	24	2826
Solano	Fairfield FS	12	38.29	122.0	38	103	69	98	68	91	66	34	24	2686
Solano	Gillespie Field	12	32.79		385	98	71	91	70	85	68	30	24	
Solano	Monticello Dam	2	38.5	122.1	505	105	71	100	70	94	68	39	26	
Solano	Suisun City	12	38.2	122.0	72	103	71	98	69	91	66	35	24	
Solano	Vacaville	12	38.40	121.9	105	103	71	100	70	94	68	40	23	2788
Solano	Vallejo	3	38.09	122.2	85	93	67	90	66	84	64	23	28	
Sonoma	Boyes Hot Sprgs	2	38.2	122.4	300	100	70	95	69	89	67	40	22	
Sonoma	Cloverdale	2	38.79	122.9	320	102	70	97	69	89	66	37	26	2763
Sonoma	Cotati	2	38.3	122.7	100	99	69	94	68	89	66	32	24	
Sonoma	Fort Ross	1	38.5	123.2	116	79	63	74	62	65	59	19	30	4127
Sonoma	Graton	2	38.40	122.8	200	95	68	91	67	82	64	34	22	3409
Sonoma	Healdsburg	2	38.59	122.8	102	102	69	95	68	90	66	37	26	2572
Sonoma	Larksfield-Wikiup	2	38.5		170	99	69	96	68	92	66	35	24	
Sonoma	Lucas Vly-Marinwood	2	38.3		20	79	63	74	62	65	59	12	30	
Sonoma	Petaluma FS 2	2	38.20	122.6	16	98	69	92	67	85	66	31	24	2959
Sonoma	Rohnert Park	2	38.40	122.5	106	99	69	96	68	92	66	33	24	
Sonoma	Roseland	2	38.4	122.7	167	99	69	96	68	92	66	35	24	
Sonoma	Santa Rosa	2	38.5	122.8	167	99	69	96	68	92	66	35	24	2980
Sonoma	Sausalito	3	37.90		10	85	66	80	65	73	63	12	30	
Sonoma	Sebastapol	2	38.4		102	99	69	96	68	92	66	35	24	
Sonoma	Sonoma	2	38.29	122.4	70	101	70	96	69	90	67	40	22	2998
Sonoma	Travis AFB	12	38.29	121.9	72	103	71	98	69	91	66	35	24	2725
Sonoma	Windsor	2	38.5		130	99	69	96	68	92	66	35	24	
Stanislaus	Ceres	12	37.59	120.9	90	101	72	96	70	90	67	36	24	
Stanislaus	Crows Landing	12	37.40	121.1	140	101	70	96	68	89	66	33	23	2767

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Stanislaus	Denair	12	37.59	120.7	137	100	70	95	69	89	67	38	22	2974
Stanislaus	Knights Ferry	12	37.79	120.5	315	103	70	99	68	94	67	37	19	
Stanislaus	Modesto	12	37.59	121.0	91	102	73	99	70	95	68	36	25	2671
Stanislaus	Newman	12	37.29	121.0	90	104	71	99	69	93	67	38	22	
Stanislaus	Oakdale	12	37.79	120.8	215	102	71	99	69	93	67	37	22	
Stanislaus	Patterson	12	37.4	121.1	97	101	72	96	70	90	67	36	24	
Stanislaus	Riverbank	12	37.7	120.9	133	102	73	99	70	95	68	36	25	
Stanislaus	Turlock	12	37.5	120.8	100	104	72	100	70	95	68	40	24	
Sutter	Live Oak	11	39.2	121.6	75	105	70	102	69	97	69	36	24	
Sutter	South Yuba City	11	39.1		59	105	69	101	69	96	68	36	24	
Sutter	Yuba City	11	39.09	121.6	70	105	69	101	69	96	68	36	24	
Tehama	Corning	11	39.9	122.1	487	106	71	103	70	98	67	33	23	
Tehama	Mill Creek	16	35.09	117.0	2940	102	67	97	66	94	65	28	28	
Tehama	Mineral	16	40.40	121.6	4911	90	60	87	59	82	57	38	2	7257
Tehama	Red Bluff AP	11	40.20	122.2	342	107	70	104	69	98	66	31	24	2688
Trinity	Big Bar RS	16	40.79	121.8	1260	102	68	98	67	93	65	46	19	
Trinity	Forest Glen	16	40.40	123.3	2340	96	65	92	64	88	62	42	12	
Trinity	Salyer RS	16	40.90	123.5	623	102	69	95	67	87	64	33	22	
Trinity	Trinity Dam	16	40.79	122.7	2500	99	65	94	64	88	62	37	17	
Trinity	Weaverville RS	16	40.70	122.9	2050	100	67	95	66	89	63	46	10	4992
Tulare	Ash Mtn	13	36.5	118.8	1708	105	69	101	68	97	66	30	25	2703
Tulare	Dinuba	13	36.5	119.3	340	104	73	101	70	96	69	36	24	
Tulare	Earlimart	13	35.8	119.2	283	106	71	102	70	98	69	36	23	
Tulare	East Porterville	13	36.1		393	106	71	102	70	97	69	36	25	
Tulare	Exeter	13	36.3	119.1	350	104	72	101	71	97	69	39	24	
Tulare	Fairview	16	35.9	118.4	3519	97	67	94	66	90	64	43	11	
Tulare	Farmersville	13	36.3	119.2	350	104	72	101	72	97	69	39	24	
Tulare	Giant Forest	16	36.59	118.7	6412	84	56	81	55	77	53	26	5	
Tulare	Grant Grove	16	36.70	118.9	6600	82	56	78	55	74	52	26	6	7044
Tulare	Lemoncove	13	36.40	119.0	513	105	72	102	70	98	68	38	25	2513
Tulare	Lindsay	13	36.20	119.0	395	105	72	101	71	97	69	40	24	2634
Tulare	Orosi	13	36.5	119.2	400	104	73	101	70	96	69	36	24	
Tulare	Porterville	13	36.09	119.0	393	106	71	102	70	97	69	36	25	2456
Tulare	Posey 3 E	13	35.79	119.0	4960	89	62	86	61	82	59	26	9	
Tulare	Three Rivers PH 1	13	36.5	118.9	1140	105	70	102	69	98	67	38	24	2642
Tulare	Tulare	13	36.20	119.3	290	105	72	101	71	96	69	39	24	
Tulare	Visalia	13	36.29	119.2	325	103	71	100	70	96	69	38	25	2459
Tulare	Woodlake	13	36.3	119.1	500	103	71	100	70	96	69	38	25	
Tuolomne	Hetch Hetchy	16	38	119.7	3870	93	62	89	61	85	59	32	14	4816
Tuolumne	Cherry Valley Dam	10	38	119.9	4765	96	62	92	61	88	59	32	9	
Tuolumne	Sonora RS	12	38	120.3	1749	103	68	100	67	95	66	34	20	3537
Tuolumne	South Entr Yosemite	16	37.5	119.6	5120	92	61	88	60	84	59	36	8	5789
Tuolumne	Strawberry Valley	16	39.59		3808	96	63	93	62	88	60	32	14	5120
Ventura	Camarillo	6	34.20	119.2	147	91	69	84	68	78	67	22	28	
Ventura	Dry Canyon Res	16	34.5	118.5	1455	105	71	100	69	96	68	32	24	
Ventura	El Rio	6	34.29	119.1	50	95	69	88	68	82	66	20	30	
Ventura	Fillmore	9	34.40	118.9	435	100	70	94	69	87	67	30	28	
Ventura	Ojai	9	34.5	119.2	750	102	71	97	69	91	68	38	25	2145
Ventura	Oxnard AFB	6	34.20	119.1	49	94	69	86	68	79	67	21	30	2068
Ventura	Point Mugu	6	34.09	119.1	14	88	68	81	67	75	66	15	33	2328
Ventura	Port Hueneme	6	34.20	119.0	13	88	68	81	67	75	66	15	33	2334

						Summer								
County	City	Climate Zone	Latitude	Longitude	Elevation	0.1% Dry Bulb	0.1% Wet Bulb	0.5% Dry Bulb	0.5% Wet Bulb	2% Dry Bulb	2% Wet Bulb	Outdoor Daily Range	Winter Median of Extremes	HDD*
Ventura	San Nicholas Island	6	33.20	119.4	504	85	66	78	65	70	64	11	39	2454
Ventura	Santa Paula	9	34.40	119.0	263	101	71	94	70	87	68	28	28	2030
Ventura	Simi Valley	9	34.40	118.7	500	98	70	93	68	87	66	30	28	
Ventura	Thousand Oaks	9	34.20	118.8	810	98	69	93	68	88	67	30	27	
Ventura	Ventura	6	34.29	119.2	341	89	68	82	67	76	66	15	29	
Yolo	Broderick-Bryte	12	38.59	121.5	20	104	71	100	69	94	67	36	25	
Yolo	Brooks Ranch	12	38.79	122.1	294	104	71	99	70	93	68	35	19	2968
Yolo	Clarksburg	12	38.40	121.5	14	102	70	97	69	91	67	35	24	2971
Yolo	Davis	12	38.5	121.7	60	103	72	99	70	93	68	41	24	2844
Yolo	West Sacramento	12	38.6	121.5	19	104	72	100	70	94	68	35	26	
Yolo	Winters	12	38.5	121.9	135	104	71	99	70	93	68	38	24	2593
Yolo	Woodland	12	38.70	121.7	69	106	72	101	71	96	69	40	25	2708
Yuba	Beale AFB	11	39.09	121.4	113	105	71	102	70	97	68	34	25	2835
Yuba	Dobbins	11	39.40	121.2	1640	104	70	101	68	96	67	31	24	
Yuba	Linda	11	39	121.5	60	105	72	102	70	97	68	30	27	
Yuba	Marysville	11	39.20	121.5	60	105	72	102	70	97	68	36	27	2552
Yuba	Olivehurst	11	39	121.5	64	105	72	102	70	97	68	36	27	

*__Heating Degree Day__ is a unit, based on temperature difference and time, used in estimating fuel consumption and specifying nominal annual heating load of a building. For any one day when the mean temperature is less than 65ºF (18ºC), there exist as many degree days as there are Fahrenheit degrees difference in temperature between mean temperature for the day and 65ºF (18ºC).

KEY TO ABBREVIATIONS:

AFB Air Force Base

AFS Air Force Station

AP Airport

CO City/County Office

FD Fire Department

FS Fire Station

MCB Marine Corps Base

NAS Naval Air Station

NM National Monument

PH Power House

RS Ranger Station

II.4 WYEC2 Climate/Weather Data Format

The ASCII versions of the WYEC2 weather files consist of 8760 identical fixed format records, one for each hour of a 365 day year. Each record is 116 characters in length and is organized according to the format shown in Table II-4, which follows.

The WYEC2 format is derived from the NOAA TD-9734 Typical Meteorological Year (TMY) format in that WYEC2 uses the same field encoding and units as TMY. However, it should be noted that ***all WYEC2 values are for Local Standard Time.*** That is, WYEC2 data should be read sequentially and used with no conversion (except any required unit conversions). This is in marked contrast to the TMY files which contain solar data for Apparent Solar Time and meteorological data for Local Standard Time.

Irradiance and illuminance fields contain data integrated over the hour, meteorological fields contain observations made at the end of the hour. For example, hour 12 contains irradiance/illuminance integrated from 11-12 and meteorological observations made at 12.

Table II-4 – WYEC DATA FORMAT

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
001	001-005	--	**WBAN station identification number** - Unique number to identify each station - California compliance files contain 00001 - 00016 in this field to indicate the climate zone
002	006-006	--	**File source code** - W = WYEC - T = TMY - C = California Compliance
003	007-014	--	**Time, Yr Mo Day Hr (2 chars each)** - Yr omits the "19" and indicates the source year for the data, i.e., 00 = 1900, 99 = 1999. Data within a single WYEC2 file may have been observed in more than one year. - Mo is 1 to 12. - Day is 1 to month length (28, 30, or 31). - Hr is 1 to 24.
101	015-018	--	**Extraterrestrial irradiance, kJ/m^2** - Amount of solar energy received at top of atmosphere during solar hour ending at time indicated in field 003, based on solar constant of 1367 kJ/m^2. - Nightime values are shown as 0.
102	019-022	023-024	**Global horizontal irradiance, kJ/m^2** - Total of direct and diffuse radiant energy received on a horizontal surface by a pyranometer during the hour ending at the time indicated in field 003.
103	025-028	029-030	**Direct normal irradiance, kJ/m^2** - Portion of the radiant energy received at the pyrheliometer directly from the sun during the hour ending at the time indicated in field 003.
104	031-034	035-036	**Diffuse horizontal irradiance, kJ/m^2** - Amount of radiant energy in kJ/m2 received at the instrument indirectly from the sky during the hour ending at the time indicated in field 003.
105	037-040	041	**Global horizontal illuminance, lux * 100**
106	042-045	046	**Direct normal illuminance, lux * 100**
107	047-050	051	**Diffuse horizontal illuminance, lux * 100**
108	052-055	056	**Zenith luminance, Cd/m^2 * 100**
110	057-058	059	**Minutes of sunshine, 0 - 60 minutes**

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
201	060-063	064	**Ceiling Height, m * 10** - Ceiling is defined as opaque sky cover of 0.6 or greater. 0000 - 3000 = 0 to 30,000 m 7777 = unlimited; clear 8888 = unknown height of cirroform ceiling
202	065-068	069	**Sky Condition** - All observations assumed to be made after 1 June 1951 ("indicator" at position 77 in TMY is omitted). - Coded by layer in ascending order; four layers are described; if less than 4 layers are present the remaining positions are coded 0. The code for each layer is: 0 = Clear of less than 0.1 cover 1 = Thin scattered (0.1 - 0.5 cover) 2 = Opaque scattered (0.1 - 0.5 cover) 3 = Thin broken (0.6 - 0.9 cover) 4 = Opaque broken (0.6 - 0.9 cover) 5 = Thin overcast (1.0 cover) 6 = Opaque overcast (1.0 cover) 7 = Obscuration 8 = Partial obscuration
203	070-073	074	**Visibility, m * 100** - Prevailing horizontal visibility. 0000-1600 = 0 to 160 kilometers 8888 = unlimited
204	075-082	083	**Weather** - Eight single digit codes as follows: Occurrence of thunderstorm, tornado or squall. 0 = None
204 (cont.)	075		1 = Thunderstorm - lightning and thunder. Wind gusts less than 50 knots, and hail, if any, less than 3/4 inch diameter. 2 = Heavy or severe thunderstorm - frequent intense lightning and thunder. Wind gusts 50 knots or greater and hail, if any, 3/4 inch or greater diameter. 3 = Report of tornado or waterspout. 4 = Squall (sudden increase of wind speed by at least 16 knots, reach 22 knots or more and lasting for at least one minute).
204 (cont.)	076		**Occurrence of rain, rain showers or freezing rain:** 0 = None 1 = Light rain 2 = Moderate rain 3 = Heavy rain 4 = Light rain showers 5 = Moderate rain showers 6 = Heavy rain showers 7 = Light freezing rain 8 = Moderate or heavy freezing rain
204 (cont.)	077		**Occurrence of drizzle, freezing drizzle:** 0 = None 1 = Light drizzle 2 = Moderate drizzle 3 = Heavy drizzle 4 = Light freezing drizzle 5 = Moderate freezing drizzle 6 = Heavy freezing drizzle

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
204 (cont.)	078		**Occurrence of snow, snow pellets or ice crystals:** 0 = None 1 = Light snow 2 = Moderate snow 3 = Heavy snow 4 = Light snow pellets 5 = Moderate snow pellets 6 = Heavy snow pellets 7 = Light ice crystals 8 = Moderate ice crystals Beginning April 1963 intensities of ice crystals were discontinued. All occurrences since this date are recorded as an 8.
204 (cont.)	079		**Occurrence of snow showers or snow grains:** 0 = None 1 = Light snow showers 2 = Moderate snow showers 3 = Heavy snow showers 4 = Light snow grains 5 = Moderate snow grains 6 = Heavy snow grains Beginning April 1963 intensities of snow grains were discontinued. All occurrences since this date are recorded as a 5.
204 (cont.)	080		**Occurrence of sleet (ice pellets), sleet showers or hail:** 0 = None 1 = Light sleet or sleet showers (ice pellets) 2 = Moderate sleet or sleet showers (ice pellets) 3 = Heavy sleet or sleet showers (ice pellets) 4 = Light hail 5 = Moderate hail 6 = Heavy hail 7 = Light small hail 8 = Moderate or heavy small hail Prior to April 1970 ice pellets were coded as sleet. Beginning April 1970 sleet and small hail were redefined as ice pellets and are coded as a 1, 2, or 3 in this position. Beginning September 1956 intensities of hail were no longer reported and all occurrences were recorded as a 5.
204 (cont.)	081		**Occurrence of fog, blowing dust or blowing sand:** 0 = None 1 = Fog 2 = Ice Fog 3 = Ground Fog 4 = Blowing dust 5 = Blowing sand These values recorded only when visibility less than 7 miles.
204 (cont.)	082		**Occurrence of smoke, haze, dust, blowing snow or blowing spray:** 0 = None 1 = Smoke 2 = Haze 3 = Smoke and haze 4 = Dust 5 = Blowing snow 6 = Blowing spray These values recorded only when visibility less than 7 miles.

Field Number	Data Positions	Flag Position (see notes)	Data Element and Description
205	084-088	089	**Station pressure, kilopascals (kPa) * 100** Pressure at station level 08000 - 10999 = 80 to 109.99 kPa.
206	090-093	094	**Dry bulb temperature, °C * 10** -700 to 0600 = -70.0 to +60.0 °C
207	095-098	099	**Dew point, °C * 10** -700 to 0600 = -70.0 to +60.0 °C
208	100-102	103	**Wind direction, 0 - 359 degrees** 0 = north Note TMY range is 0-360, WYEC2 has recoded 360 as 0.
209	104-107	108	**Wind speed, m/s * 10** 0 - 1500 = 0 to 150.0 m/s. Wind speed and wind direction both 0 indicates calm.
210	109-110	111	**Total Sky Cover, 0 - 10 in tenths** Amount of celestial dome in tenths covered by clouds or obscuring phenomena.
211	112-113	114	**Opaque Sky Cover, 0 - 10 in tenths** Amount of celestial dome in tenths covered by clouds or obscuration through which the sky and/or higher cloud layers cannot be seen.
212	115-115	116	**Snow Cover** 0 = no snow or a trace of snow 1 = indicates more than a trace of snow on the ground

Notes for Table II-4 – WYEC DATA FORMAT**:**

1. Total file size (including CRLFs) = 118 x 8,760 = 1,033,680 characters.
2. Flag characters indicate the source of the associated value and, in the case of solar fields, optionally give information about the quality of the value.

Some fields have no flag, others have 1 or 2 character flags as follows:

Field	Flag Type/Comment
001 – 003	None (record identification fields)
101	None (calculated extraterrestrial irradiance is always present)
102 – 1042	Character (irradiance values)
105 – 2121	Character (all remaining fields)

One character flags are alphabetic (with the exception of 9 for missing) and are defined as follows:

(blank) Value was observed (that is, not derived with a model and not altered.)

A Value has been algorithmically adjusted (e.g., dry bulb temperatures were shifted to match long term means).

E Value was missing and has been replaced by a hand estimate.

F Value was bad and has been replaced by a hand estimate.

I Value was missing and has been replaced with one derived by interpolation from neighboring observations.

J Value was bad and has been replaced with one derived by interpolation from neighboring observations.

M Value was missing and has been replaced with one derived with a model (model used depends on element).

N Value was bad and has been replaced with one derived with a model (model used depends on element).

P Value violated a physical limit and has been replaced by that limit.

Q Value is derived from other values (e.g., illuminance data which were not observed).

9 Value is missing; data positions contain 9s as well.

Two character flags (on irradiance fields 102, 103, and 104) are *either*:

A 1 Character flag (as defined above) followed by a blank, or

A 2 Character numeric value in the range 00 to 99 and are defined in *SERI Standard Broadband Format 2*, as follows:

00 Element is untested (original data)

01-03 Element passed tests on physical limits, model limits (for tolerances less than 3%), and reasonable coupling to other parameters (for tolerances less than 3%).

04 Element passed hand/eye tests.

05 Element failed hand/eye tests and has not been corrected.

06 Element was missing and has not been replaced with an estimate.

07 Element's value is lower than a physical limit.

08 Element's value is higher than a physical limit.

09 Element's value is inconsistent with other components (e.g. direct not consistent with global)

10-93 Element exceeded the 3% tolerance in one of four ways. The following error types are defined:

0 = too low by 3-parameter coupling

1 = too high by 3-parameter coupling

2 = too low by 2D boundary comparison

3 = too high by 2D boundary caparison

The flags in this range are constructed in such a way that both the percentage of error and the type of error are encoded in the two digit flag. To create the flag, one multiplies the percentage of disagreement by 4, subtract 2, and add the error type. The percentage of error should be truncated - only the integer part is used.

The particular error is determined by the remainder of MOD(IQC=2 / 4), where "MOD0 is a mathematical function representing the remainder of the quantity (IQC+2)/4 and "IQC" is the two digit flag number. The percentage error is determined by

IPCT = Int((IQC + 2) /4)

IPCT = 23 indicates an error greater than 23%.

94-97 KN = KT + ERR

FLAG	ERR
94	5% ETR <= ERR <10% ETR
95	10% ETR <= ERR <15% ETR
96	15% ETR <= ERR < 20% ETR
97	20% ETR <= ERR
99	Element is missing or null.

It should be noted that the 2 character numeric flags are appropriate for encoding the results of quality control processing of archival solar data. The 1 character alphabetic flags are appropriate for "best estimate" data sets in which any questionable values have been replaced. Most WYEC2 files used for engineering purposes will fall into the latter category and will thus use the alphabetic flags on solar fields.

3. Missing elements are 9 filled: all data and flag positions contain 9s.

4. Conversion factors relevant to WYEC2 use:

To convert from	To	Multiply By
kj/m^2	Btu/ft^2	0.08807
m/s * 10	mph	0.2273
kPai	n. Hg.	0.002953
m * 10	ft	32.808
m * 100 miles	miles	0.06214

II.5 Climate/Weather Data Adjustments for Local Conditions

Note: This section is related to nonresidential buildings only.

This appendix section describes the official procedure used by the California Energy Commission to adjust the Title 24 climate zone data for the sixteen (16) climate zones to match the ASHRAE design day conditions for a specific city.[1] Computer software available from the California Energy Commission takes weather data from one of the sixteen climate zones and uses ASHRAE design data for a specific city within that climate zone to create weather data in the format required by the DOE-2 building simulation program.[2] The generated weather data has the latitude, longitude, elevation and air properties of a particular city instead of the climate zone's designated weather station indicated in Table D-3. This procedure only modifies the weather data on the climate zone data file to match a city's design conditions for the days which fall within the ASHRAE summer and winter design day percentage levels. However, the entire data set is adjusted to reflect the city's elevation. This city-specific data into DOE-2 allows the program's Heating Ventilation and Air-Conditioning (HVAC) sizing procedures to use design conditions closer to the simulated building's actual location. This section outlines the procedure used to incorporate a city's design day data into an hourly climate zone data set.

II.5.1 Background

The California Energy Commission, in developing and implementing the Title 24 building energy efficiency standards, has defined sixteen zones that encompass the diversity of California's climatic regions. Each climate zone's hourly weather data set has been derived, predominantly, from a single weather station. Past work sponsored by the Commission modified these data sets to reflect the weather conditions of specific geographic areas within certain climate zones where high levels of building construction were anticipated. This modified Title 24 climate zone data, however, does not represent the particular climatic conditions of any individual city or a specific building site but rather the climate zone as a whole. The weather adjustments described below are intended to increase a compliance program's ability to properly size and simulate HVAC systems.

II.5.2 Reference Year[2]

The 1991 calendar year must be used as the basis for the frequency and timing of the occurrence of holidays, Saturdays and Sundays. The reference method observes the holidays listed in Section 2.3.3.3 of the Nonresidential ACM. This is a fixed compliance input that must be the same for both the standard and proposed designs. The reference method uses CECREV2 hourly data in WYEC format for the sixteen climate zones. Weather data is available in DOE compressed format for the reference computer simulation program along with programs to produce weather data from these files customized to the design weather data for each city in California. The weather data is also available in archived ASCII format for all 8760 hours for each of the 16 climate zones.

II.5.3 Definitions

CITY	One of the California cities listed in ASHRAE's CLIMATIC DATA FOR REGION X
TAPE	Hourly data which describes the regional weather patterns for one of the 16 California climate zones
RH	Relative Humidity (%)
DB	Dry Bulb temperature (^{o}F)
WB	Wet Bulb temperature (^{o}F)

[2] This section used to be in Ch. 2 of the Nonresidential ACM.

P	Pressure (psia)
MIN	Minimum Daily Dry Bulb Temperature (^oF)
MAX	Maximum Daily Dry Bulb Temperature (^oF)
AVG	Average Daily Dry Bulb Temperature (^oF)
	=MAX - MIN) / 2
RANGE	Daily Dry Bulb Temperature Range (^oF)
	= (MAX - MIN)
RH RATIO	The Daily Ratio of RH_{MAX} for the CITY to RH_{MAX} for the TAPE
ODR	Outdoor Daily Range (^oF) as defined by ASHRAE: the difference between the average maximum and average minimum temperature for the warmest month
F	An hourly temperature function derived from the TAPE
	= (DB_{HR} - AVG) / RANGE

II.5.4 Methodology

First, the climate zone design conditions as specified by ASHRAE are computed from the TAPE. The maximum DB is also found off the TAPE. The CITY maximum DB is computed as:

$$CITY_{max\ DB} = TAPE_{max\ DB} * CITY_{0.1\%\ DB} / TAPE_{0.1\%\ DB} . \quad [1]$$

The psychrometric equations are used to derive RH for the TAPE design conditions[3]. The atmospheric pressure is adjusted for the CITY elevation, then RH is computed for the CITY design conditions. The form of equation [1] is used to derive the CITY maximum RH, using the TAPE maximum RH and the RH values computed for the TAPE and the CITY at the 0.1% DB conditions.

For each day of the year the following steps are completed:

1. MAX, Min, AVG, RAGE, WB_{MAX} and RH_{MAX} are determined for the TAPE,
2. A mapping procedure, delineated in Figure 1, is used to find RH_{MAX} for the CITY from the CITY RH design values, the TAPE DB design values and MAX for the TAPE,
3. RH_{MAX} and RH RATIO are determined for the CITY. The RH RATIO is set to 1 for all days with MAX less than the CITY 2.0% maximum DB, which equates the RH of the CITY to the RH of the TAPE for all non-design days,
4. MAX and MIN for the CITY are computed using mapping procedures similar to that illustrated in Figure 1, from the CITY DB design conditions, the TAPE DB design conditions and MAX/MIN for the TAPE,
5. MAX and MIN for the CITY are corrected for the CITY elevation[4],
6. RANGE is calculated for the CITY. RANGE is adjusted by the ratio of the ODR for the CITY to the ODR of the TAPE if MAX is greater then the CITY 2.0% maximum DB,
7. AVG for the CITY is calculated in one of three ways:
   (a) AVG = MAX -5.0* RANGE,
   if MAX > CITY 2.0% maximum DB, or
   (b) AVG = MIN + 0.5* RANGE,
   if MIN < CITY 0.6% minimum DB, or
   (c) AVG = (MAX + MIN) / 2.

Once the daily CITY statistics are computed, they can be applied to the hourly TAPE to generate an hourly CITY weather data set. For each hour of the year, the following steps are completed.

1. F is calculated from the Tape,
2. P is corrected for CITY elevation,
3. RH is calculated for the TAPE,
4. RH for the CITY is derived by applying the RH RATIO to the RH for the TAPE,
5. DB for the CITY is computed: DB = AVG + F * RANGE,
6. WB is calculated using the new values for RH, DB and P for the CITY.

Upon completion of all weather adjustments the resulting data set is converted to the binary format required by the DOE-2 simulation program.

II.5.5 Results

An example of the hourly weather adjustments from a TAPE to a CITY is displayed in figure 2. Four summer days are extracted from both the climate zone 16 data (Mt. Shasta) and the city-specific data (Tahoe City). The first day plotted falls below the design day threshold; the next three days plotted are design days. The figure depicts the expected downshift of hourly temperatures from Mt. Shasta (maximum DB = 96^0F) to Tahoe City (maximum DB = 87^0F).

II.5.6 Software Package

To obtain the software used to adjust DOE-2 files to local design conditions for 641 California cities that is described in this section, write to:

Local Weather Software
Energy Efficiency and Demand Analysis Division
California Energy Commission
1516 Ninth St., MS-28
Sacramento, Ca 95814-5512

You must include a self-addressed, stamped diskette mailer and a preformatted 1.44 megabite disk.

NOTES for SECTION II.5

1. ASHRAE Publication SPCDX, CLIMATIC DATA FOR REGION X: ARIZONA, CALIFORNIA, HAWAII, NEVADA, defines a city's design day conditions as the ambient dry bulb and wet bulb temperatures which are percentage levels of hours on an annual basis: Summer values are presented for the 0.1%, 0.5% and 2.0% of the annual maximum dry bulb temperature; Winter values are presented for the median, the 0.2% and 0.6% of the annual minimum dry bulb temperature. This publication lists design day data for 641 California cities.
2. The computer software described herein produces two output files. The first file is the hourly weather data in binary DOE-2 format. To produce this file staff has incorporated a program created by Jeff Hirsch (James J. Hirsch and Associates) which converts an ASCII data file into the packed DOE-2 file format. This file is compatible with the DOE-2 program compiled and distributed by James J. Hirsch and Associates as well as several other PC versions of DOE-2. The second file produced is an ASCII file that contains building location data as well as specific design data required by the CEC's nonresidential Alternative Calculation Method (ACM) procedures.
3. The mathematical equations which describe the thermodynamic properties of moist air are published in the ASHRAE HANDBOOK FUNDAMENTALS Volume, PSYCHROMETRICS Chapter. The relative humidity (RH) which corresponds to specific dry bulb and wet bulb temperatures is derived by these principles of psychrometrics throughout this weather adjustment procedure.

4. Elevation adjustments to dry bulb temperature and pressure are made using the standard atmospheric data published in the ASHRAE FUNDAMENTALS Volume, PSYCHROMETRIC Chapter.

ACM III

Time Dependent Valuation (TDV)

IV.1 Scope and Purpose

Time dependent valuation (TDV) is the currency used to compare energy performance when the performance compliance method is used. TDV is also used to evaluate the cost effectiveness of measures and to perform other codes analysis. TDV replaces source energy, which was used to compare performance prior to the 2005 Standards.

TDV consists of large data sets that convert electricity, gas or propane to TDV energy. The rate of conversion varies for each hour of the year, for each climate zone and for each energy type (electricity, natural gas or propane). The conversion factors also vary by building type: low-rise residential and other building types, including nonresidential, hotel/motel and high-rise residential. There are a total of 96 hourly data sets (16 climates x 3 energy types x 2 building types). The actual TDV data may be downloaded from http://www.h-m-g.com/TDV/index.htm. Because of the length, the actual data is not published in this appendix.

NOTE: THE CEC WILL SET UP A PLACE ON ITS WEBSITE WHERE INTERESTED PERSONS CAN GO TO DOWNLOAD THE DATA. FOR NOW, THE HMG WEBSITE IS LISTED SINCE THE DATA CAN CURRENTLY BE REVIEWED FROM THIS LOCATION.

IV.2 Summary of Data

Table III-1 through Table III-3 give a statistical summary of the TDV conversion factors for electricity, natural gas and propane. Each table has the annual minimum, maximum, and average for each climate zone and building type.

- Table III-1 – TDV Statistical Data – Electricity
- Table III-2 – TDV Statistical Data – Natural Gas
- Table III-3 – TDV Statistical Data – Propane

Figure III-1 through Figure III-8 show typical variation in the TDV conversion factors for climate zone 12 (Sacramento). Electricity variation is shown for the whole year (Figure III-1 and Figure III-3) and for the Month of July (Figure III-2 and Figure III-4). Variation is greatest for electricity. Figure III-5 through Figure III-8 show the annual variation for natural gas and propane; note that there is no daily or hourly variation, only monthly variation.

- Figure III-1 – Residential Electricity – Climate Zone 12 – Annual
- Figure III-2 – Residential Electricity – Climate Zone 12 – July
- Figure III-3 – Nonresidential Electricity – Climate Zone 12 – Annual
- Figure III-4 – Nonresidential Electricity – Climate Zone 12 – July
- Figure III-5 – Residential Natural Gas – Climate Zone 12 – Annual
- Figure III-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual
- Figure III-7 – Residential Propane – Climate Zone 12 – Annual
- Figure III-8 – Nonresidential Propane – Climate Zone 12 – Annual

Table III-1 – TDV Statistical Data – Electricity

Climate	Residential			Nonresidential		
Zone	Minimum	Average	Maximum	Minimum	Average	Maximum
1	6.74	12.60	52.52	8.86	16.91	67.88
2	6.77	12.63	54.83	8.86	16.91	67.88
3	6.84	12.70	61.60	8.85	16.89	77.11
4	6.81	12.66	84.13	8.85	16.89	105.15
5	6.83	12.69	70.58	8.88	16.92	87.12
6	6.21	13.94	51.94	8.99	19.12	66.46
7	7.61	14.07	50.52	8.81	17.49	63.72
8	6.14	13.88	63.32	8.95	19.08	80.56
9	6.09	13.82	75.65	8.95	19.07	94.58
10	6.04	13.78	62.87	8.95	19.08	80.47
11	6.73	12.59	50.06	8.90	16.94	64.88
12	6.74	12.60	65.32	8.88	16.92	83.07
13	6.73	12.58	48.08	8.89	16.93	62.53
14	6.05	13.78	56.35	8.99	19.12	72.66
15	6.03	13.76	57.36	8.97	19.10	73.98
16	6.75	12.61	55.44	8.90	16.94	71.36

Table III-2 – TDV Statistical Data – Natural Gas

Climate	Residential			Nonresidential		
Zone	Minimum	Average	Maximum	Minimum	Average	Maximum
1	87.07	94.85	104.74	99.16	108.01	119.28
2	87.07	94.85	104.74	99.16	108.01	119.28
3	87.07	94.85	104.74	99.16	108.01	119.28
4	87.07	94.85	104.74	99.16	108.01	119.28
5	87.07	94.85	104.74	99.16	108.01	119.28
6	97.39	105.08	115.84	87.75	94.68	104.37
7	90.58	106.01	117.21	94.14	110.17	121.81
8	97.39	105.08	115.84	87.75	94.68	104.37
9	97.39	105.08	115.84	87.75	94.68	104.37
10	97.39	105.08	115.84	87.75	94.68	104.37
11	87.07	94.85	104.74	99.16	108.01	119.28
12	87.07	94.85	104.74	99.16	108.01	119.28
13	87.07	94.85	104.74	99.16	108.01	119.28
14	97.39	105.08	115.84	87.75	94.68	104.37
15	97.39	105.08	115.84	87.75	94.68	104.37
16	87.07	94.85	104.74	99.16	108.01	119.28

Table III-3 – TDV Statistical Data – Propane

Climate	Residential			Nonresidential		
Zone	Minimum	Average	Maximum	Minimum	Average	Maximum
1	156.71	172.52	185.79	165.18	183.40	198.68
2	156.71	172.52	185.79	165.18	183.40	198.68
3	156.71	172.52	185.79	165.18	183.40	198.68
4	156.71	172.52	185.79	165.18	183.40	198.68
5	156.71	172.52	185.79	165.18	183.40	198.68
6	156.71	172.52	185.79	165.18	183.40	198.68
7	156.71	172.52	185.79	165.18	183.40	198.68
8	156.71	172.52	185.79	165.18	183.40	198.68
9	156.71	172.52	185.79	165.18	183.40	198.68
10	156.71	172.52	185.79	165.18	183.40	198.68
11	156.71	172.52	185.79	165.18	183.40	198.68
12	156.71	172.52	185.79	165.18	183.40	198.68
13	156.71	172.52	185.79	165.18	183.40	198.68
14	156.71	172.52	185.79	165.18	183.40	198.68
15	156.71	172.52	185.79	165.18	183.40	198.68
16	156.71	172.52	185.79	165.18	183.40	198.68

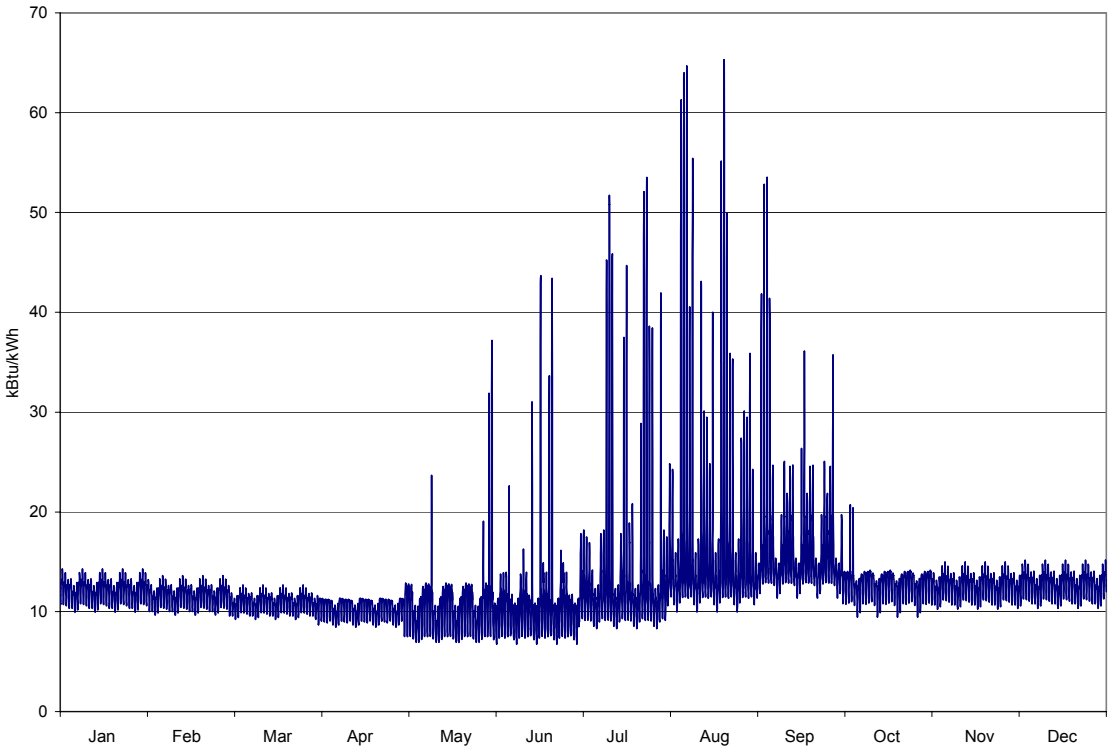


Figure III-1 – Residential Electricity – Climate Zone 12 – Annual

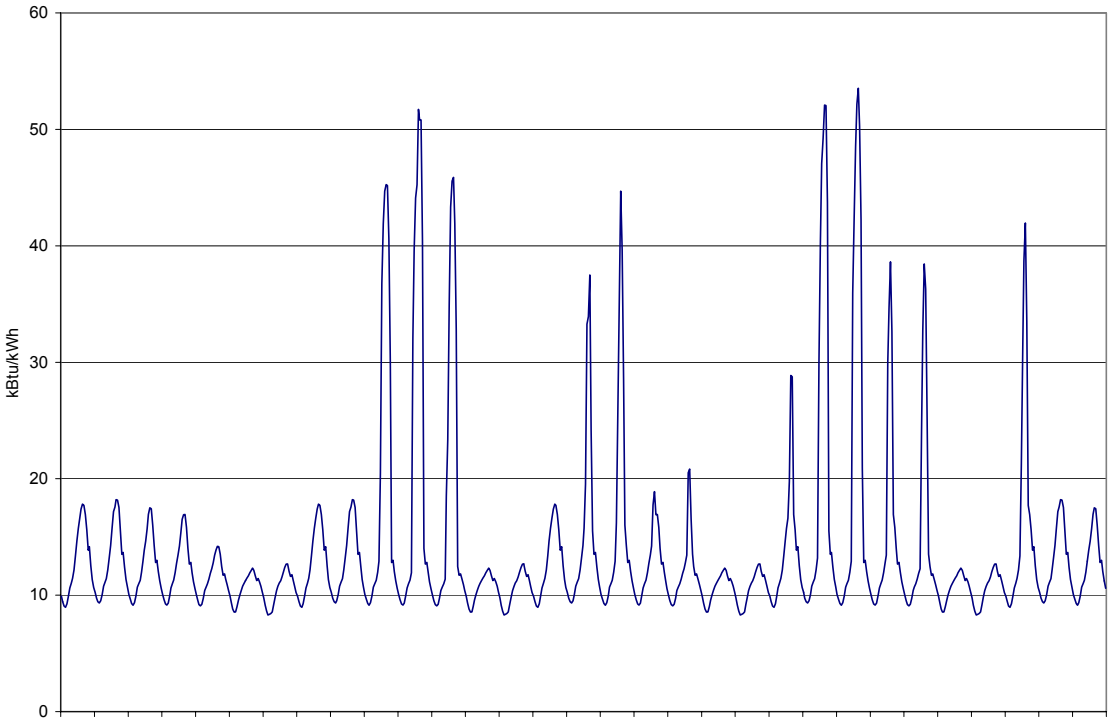


Figure III-2 – Residential Electricity – Climate Zone 12 – July

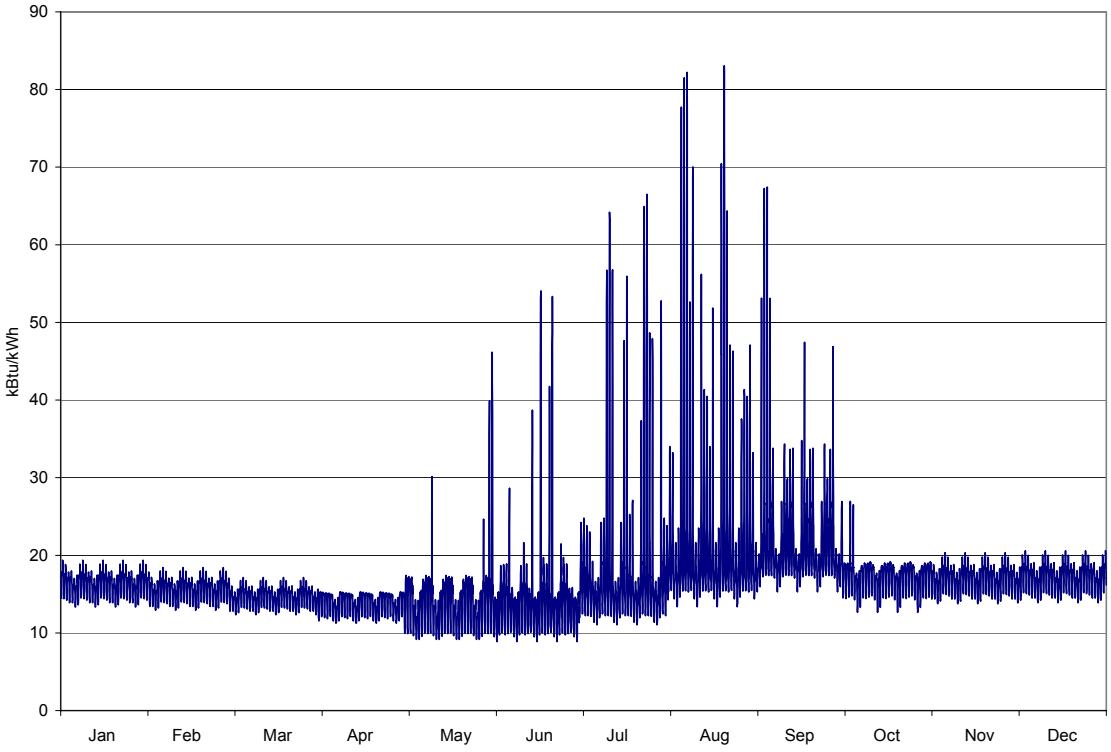


Figure III-3 – Nonresidential Electricity – Climate Zone 12 – Annual

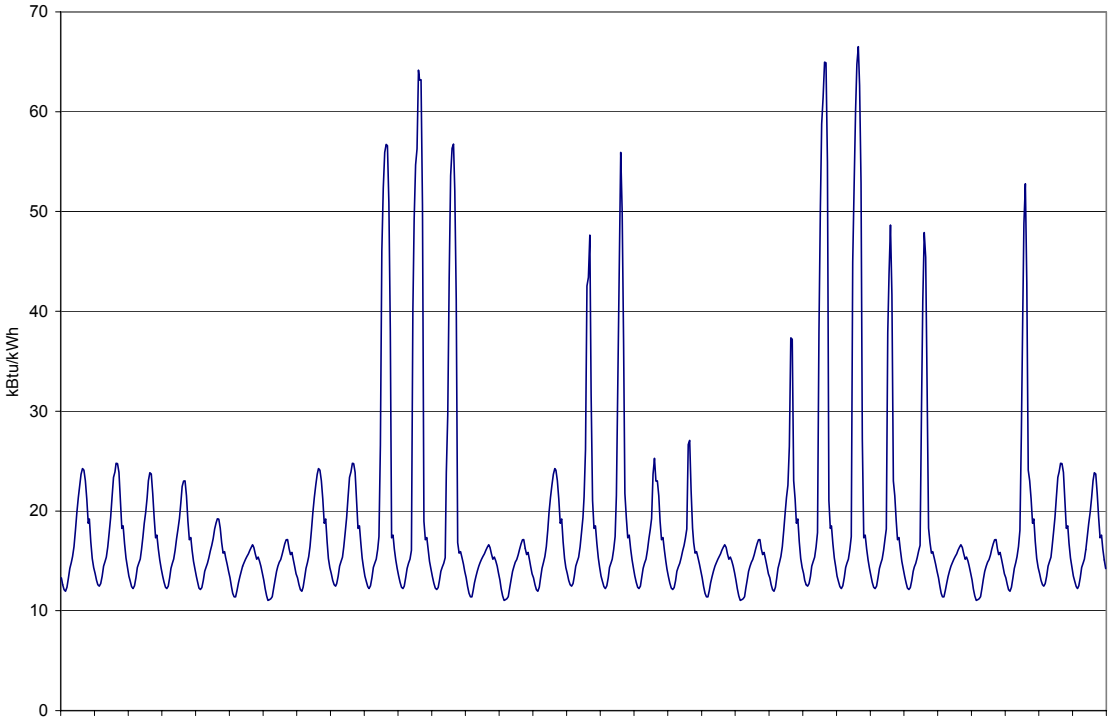


Figure III-4 – Nonresidential Electricity – Climate Zone 12 – July

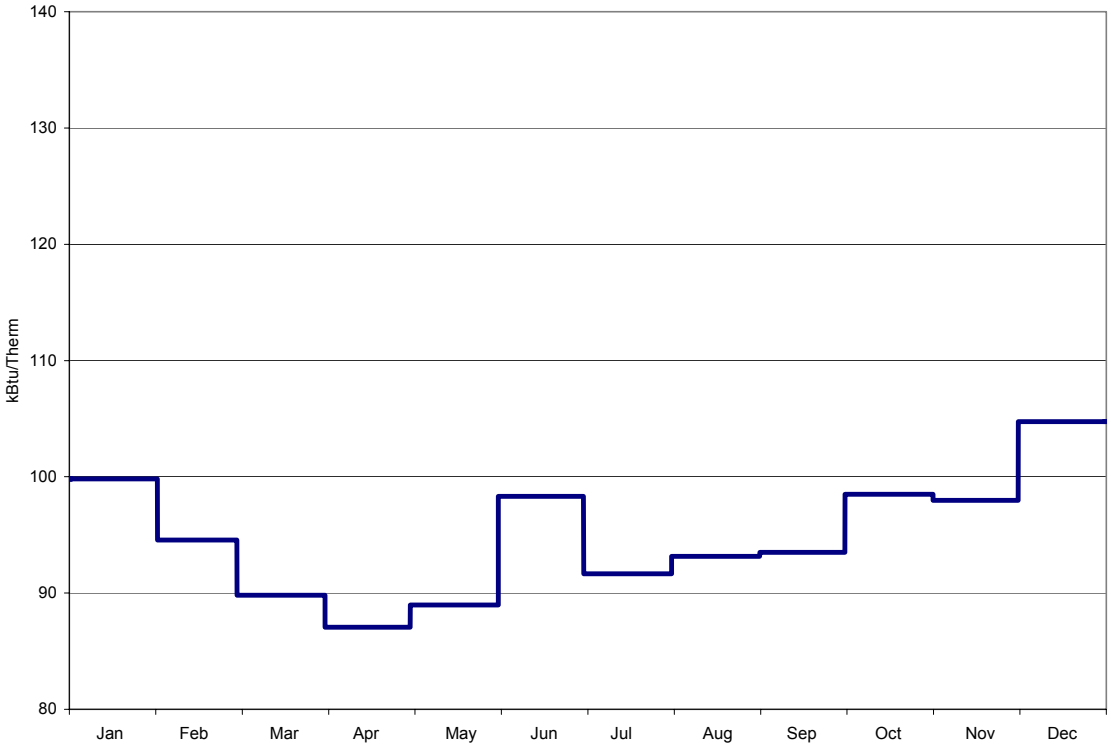


Figure III-5 – Residential Natural Gas – Climate Zone 12 – Annual

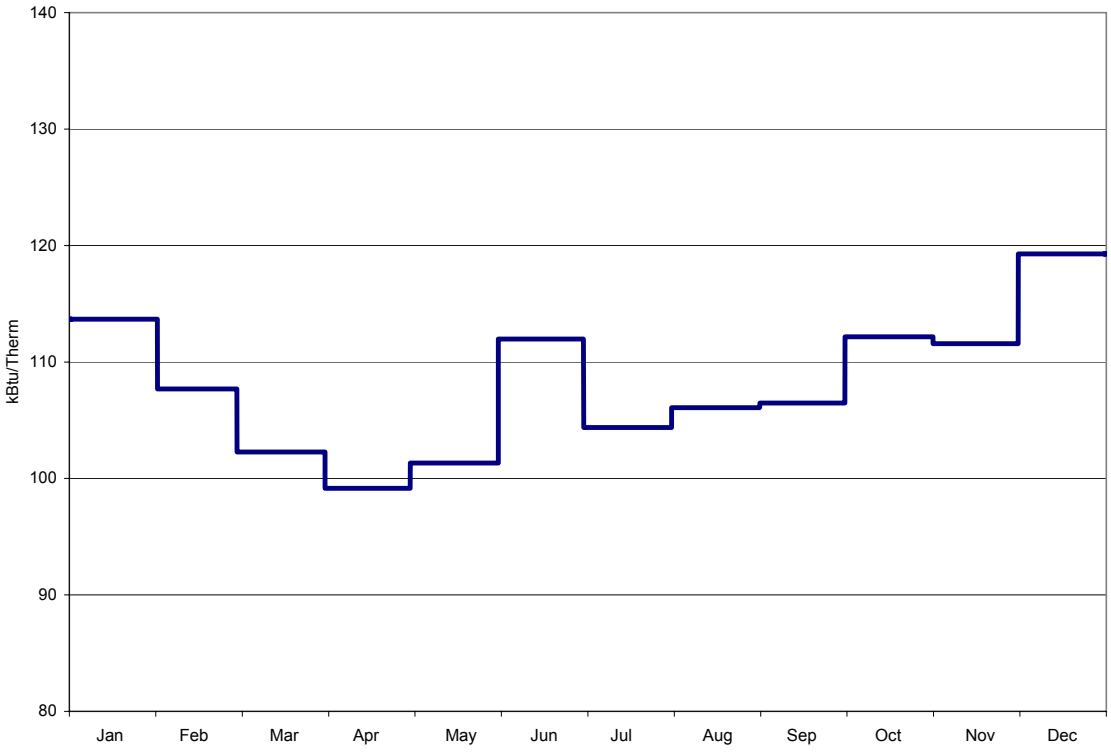


Figure III-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual

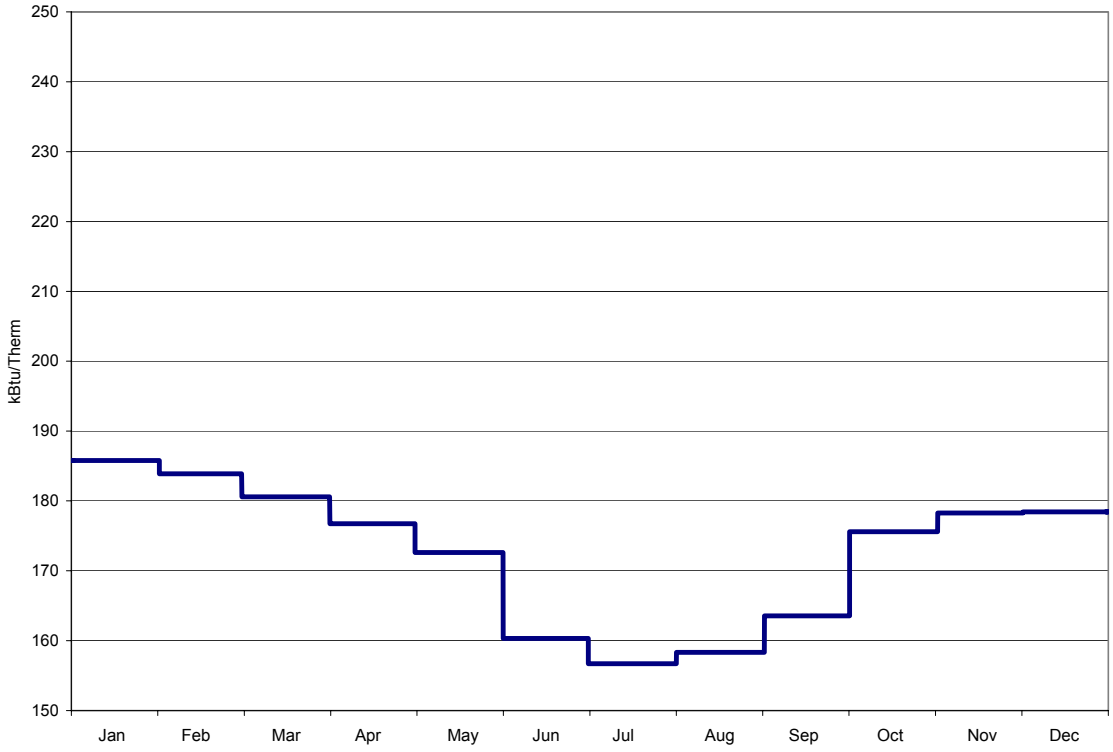


Figure III-7 – Residential Propane – Climate Zone 12 – Annual

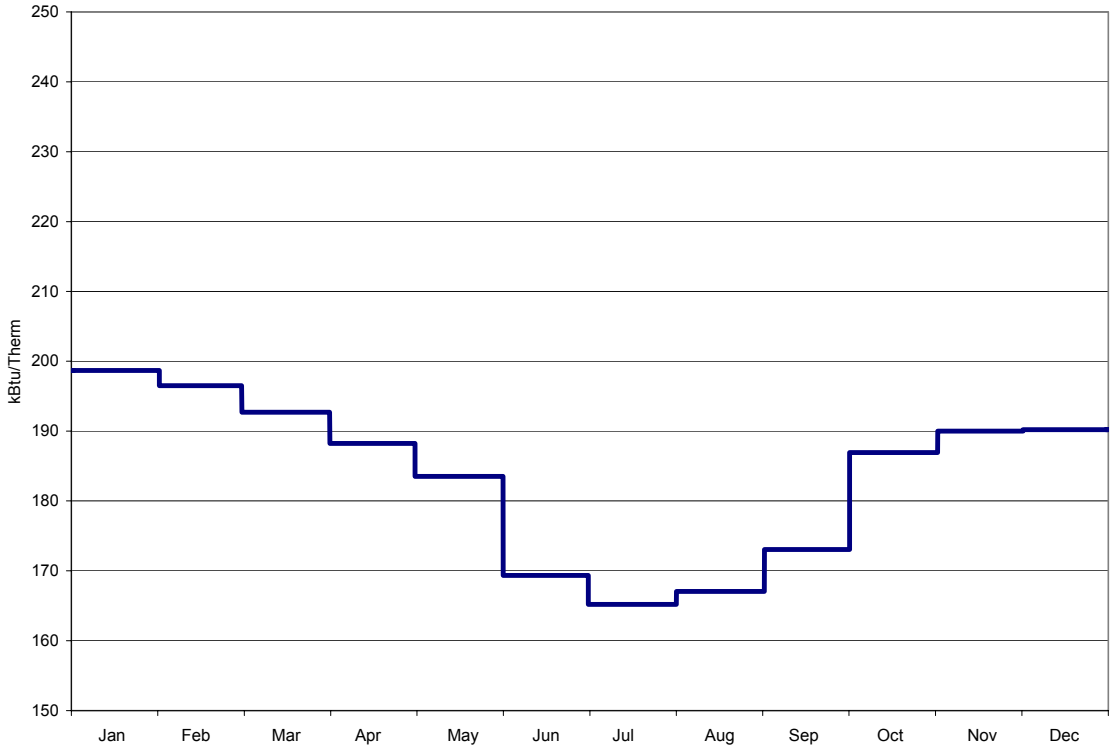


Figure III-8 – Nonresidential Propane – Climate Zone 12 – Annual

ACM IV

U-factor, C-factor, and Thermal Mass Calculations

List of Tables

Scope

All buildings subject to the Energy Efficiency Standards for Residential and Nonresidential Buildings

Purpose

This appendix provides the California Energy Commission official method for determining U-factors, C-factors, effective R-values, and thermal mass calculations for building constructions.

IV.1 U-factor Lookup Tables

Lookup tables allow users to determine the U-factor of a particular construction assembly without calculations. In the tables below, continuous insulation assumes that the insulation is continuous and uninterrupted by framed, except where noted. Interpolation between values in a particular table is allowed; however extrapolation beyond the table is not allowed. The units of U-factor are Btu/h*ft^2*°F. Units of R-value are h*ft^2*°F/Btu at a mean temperature of 75°F. The units of heat capacity are Btu/ft^2*°F.

If a construction assembly is not adequately represented in the tables below, Section IV.2 may be reviewed to determine if the U-factor for the particular construction assembly can be calculated.

Table IV.1 – Standard U-factors of Wood Framed Walls

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY										
			Rated R-value of Continuous Insulation										
			R-0	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
16 in. OC													
	2 x 4	None (0.0)	**0.356**	0.259	0.204	0.169	0.144	0.126	0.111	0.100	0.091	0.083	0.077
	(3.5 in.)	R-11 (11.0)	**0.110**	0.097	0.087	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.050
		R-13 (13.0)	**0.102**	0.090	0.081	0.074	0.068	0.063	0.059	0.056	0.052	0.050	0.047
		R-15 (15.0)	**0.095**	0.084	0.076	0.070	0.064	0.060	0.056	0.053	0.050	0.047	0.045
	2 x 6	R-19 (18.0)1	**0.074**	0.068	0.063	0.058	0.055	0.051	0.049	0.046	0.044	0.042	0.040
	(5.5 in.)	R-21 (21.0)	**0.069**	0.063	0.058	0.054	0.051	0.048	0.046	0.043	0.041	0.039	0.038
	2 x 8	R-19 (19.0)	**0.065**	0.061	0.057	0.053	0.050	0.048	0.045	0.043	0.041	0.039	0.038
	(7.25 in.)	R-22 (22.0)	**0.061**	0.056	0.053	0.050	0.047	0.045	0.042	0.040	0.039	0.037	0.036
		R-25 (25.0)	**0.057**	0.053	0.050	0.047	0.044	0.042	0.040	0.038	0.037	0.035	0.034
		R-30 ()1	**0.056**	0.052	0.049	0.046	0.043	0.041	0.039	0.038	0.036	0.035	0.033
	2 x 10	R-30 (30.0)	**0.047**	0.044	0.042	0.040	0.038	0.036	0.035	0.034	0.032	0.031	0.030
	(9.25 in.)	R-38 ()1	**0.046**	0.043	0.041	0.039	0.037	0.035	0.034	0.033	0.031	0.030	0.029
24 in. OC													
	2 x 4	None (0.0)	**0.362**	0.263	0.207	0.171	0.145	0.127	0.112	0.101	0.092	0.084	0.077
	(3.5 in.)	R-11 (11.0)	**0.106**	0.094	0.085	0.078	0.072	0.066	0.062	0.058	0.055	0.052	0.049
		R-13 (13.0)	**0.098**	0.087	0.079	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.046
		R-15 (15.0)	**0.091**	0.081	0.073	0.067	0.062	0.058	0.055	0.051	0.049	0.046	0.044
	2 x 6	R-19 (18.0)	**0.071**	0.066	0.061	0.057	0.053	0.050	0.047	0.045	0.043	0.041	0.039
	(5.5 in.)	R-21 (21.0)	**0.066**	0.061	0.056	0.053	0.049	0.047	0.044	0.042	0.040	0.038	0.037
	2 x 8	R-19 (19.0)	**0.062**	0.057	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036
	(7.25 in.)	R-22 (22.0)	**0.057**	0.053	0.050	0.047	0.045	0.042	0.040	0.039	0.037	0.035	0.034
		R-25 (25.0)	**0.053**	0.050	0.047	0.044	0.042	0.040	0.038	0.036	0.035	0.034	0.032
		R-30 ()1	**0.052**	0.049	0.046	0.043	0.041	0.039	0.037	0.036	0.034	0.033	0.032
	2 x 10	R-30 (30.0)	**0.044**	0.042	0.040	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029
	(9.25 in.)	R-38 ()1	**0.043**	0.041	0.038	0.037	0.035	0.033	0.032	0.031	0.030	0.029	0.028

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

Assumptions:

These calculations assume an exterior air film of R-0.17, a 7/8" layer of stucco of R-0.18, building paper of R-0.06, continuous insulation (if any), the insulation / framing layer, 1/2" gypsum of R-0.45, and an interior air film 0.68.

Table IV.2 – Standard U-factors of Wood Foam Panel Walls

Insulation R-value	Framing Spacing	Reference Name	U-factor
R-14	48 in. o.c.	WP.14.2x4.48	0.071
R-22	48 in. o.c.	WP.22.2x4.48	0.049

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

Assumptions:

These calculations assume an exterior air film of R-0.17, a 7/8" layer of stucco of R-0.18, building paper of R-0.06, continuous insulation (if any), 3/8" plywood of R-0.47, the insulation / framing layer, 3/8" plywood of R-0.47, 1/2" gypsum of R-0.45, and an interior air film 0.68.

Table IV.3 – Standard U-factors of Wood Framed Attic Roofs

Spacing	**Framing Type (Actual depth)**	**Cavity Insulation R-Value:**	**OVERALL U-FACTOR FOR ASSEMBLY**										
			Rated R-value of Continuous Insulation										
			R-0	**R-1**	**R-2**	**R-3**	**R-4**	**R-5**	**R-6**	**R-7**	**R-8**	**R-9**	**R-10**
16 in. OC													
	2 x 4	None (0.0)	**0.300**	0.229	0.186	0.156	0.135	0.119	0.106	0.096	0.087	0.080	0.074
	(3.5 in.)	R-11	**0.079**	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.047	0.045	0.043
		R-13	**0.071**	0.066	0.061	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.040
		R-19	**0.049**	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033
		R-22	**0.043**	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030
		R-25	**0.038**	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027
		R-30	**0.032**	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.025	0.025	0.024
		R-38	**0.026**	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.021	0.021	0.020
		R-49	**0.020**	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017	0.017
		R-60	**0.017**	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.014	0.014
24 in. OC													
	2 x 4	None (0.0)	**0.305**	0.233	0.188	0.158	0.136	0.120	0.107	0.097	0.088	0.081	0.075
	(3.5 in.)	R-11	**0.076**	0.071	0.066	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.043
		R-13	**0.068**	0.063	0.059	0.056	0.053	0.050	0.048	0.045	0.043	0.041	0.040
		R-19	**0.048**	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032
		R-22	**0.042**	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029
		R-25	**0.037**	0.036	0.035	0.034	0.032	0.031	0.030	0.030	0.029	0.028	0.027
		R-30	**0.032**	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024
		R-38	**0.025**	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.021	0.021	0.020
		R-49	**0.020**	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.017	0.017	0.017
		R-60	**0.016**	0.016	0.016	0.016	0.015	0.015	0.015	0.015	0.015	0.014	0.014

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

Assumptions:

2 x 4 framing is used at the ceiling level

R-13 of insulation is installed between the framing members; above that level, insulation is continuous.

7.25% of the continuous insulation above the framing members is assumed to be at half depth, due to decreased depth of insulation at the edges.

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, ½" of plywood of R-0.63, the attic air space (greater than 3.5") of R-0.80, the insulation / framing layer, 1/2" gypsum of R-0.45, and an interior air film (heat flow up) of R-0.61.

Table IV. 4 – Standard U-factors of Wood Framed Rafter Roofs

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY										
			Rated R-value of Continuous Insulation										
			R-0	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
16 in. OC													
	2 x 6	None (0.0)	**0.297**	0.227	0.184	0.155	0.134	0.118	0.105	0.095	0.087	0.080	0.074
	(5.5 in.)	R-11 (11.0)	**0.076**	0.071	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043
		R-13 (13.0)	**0.069**	0.064	0.060	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040
		R-15 (15.0)	**0.062**	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038
	2 x 8	R-19 (19.0)	**0.051**	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033
	(7.25 in.)	R-21 (21.0)	**0.048**	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.031
	2 x 10	R-22 (22.0)	**0.044**	0.042	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030
	(9.25 in.)	R-25 (25.0)	**0.041**	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028
		R-30 (30)1	**0.036**	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026
	2 x 12	R-30 (30.0)	**0.035**	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025
	(11.25 in.)	R-38 (38.0)1	**0.029**	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.022	0.022
	2 x 14	R-38 (38.0)	**0.028**	0.027	0.027	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022
	(13.25 in.)												
24 in. OC													
	2 x 6	None (0.0)	**0.237**	0.191	0.160	0.138	0.121	0.108	0.097	0.089	0.081	0.075	0.070
	(5.5 in.)	R-11 (11.0)	**0.075**	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.046	0.044	0.042
		R-13 (13.0)	**0.067**	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.040
		R-15 (15.0)	**0.060**	0.057	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.038	0.037
	2 x 8	R-19 (19.0)	**0.049**	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033
	(7.25 in.)	R-21 (21.0)	**0.046**	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031
	2 x 10	R-22 (22.0)	**0.043**	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030
	(9.25 in.)	R-25 (25.0)	**0.039**	0.038	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.028
		R-30 (30)1	**0.034**	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025
	2 x 12	R-30 (30.0)	**0.033**	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025
	(11.25 in.)	R-38 (38.0)1	**0.028**	0.027	0.026	0.025	0.025	0.024	0.023	0.023	0.022	0.022	0.021
	2 x 14	R-38 (38.0)	**0.027**	0.026	0.026	0.025	0.024	0.024	0.023	0.022	0.022	0.021	0.021
	(13.25 in.)												

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

[1] Higher density fiberglass batt: R-30 in 2 x 10 rafter cavity is the 8.5" thick batt; R-38 in 2 x 12 rafter cavity is the 10.5" thick batt.

Assumptions:

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, ½" of plywood of R-0.63, the insulation / framing layer with an air space of R-0.76 or R-0.80, 1/2" gypsum of R-0.45, and an interior air film (heat flow up diagonally) of R-0.62.

Table IV.5 – Standard U-factors of Wood Foam Panel Roof/Ceilings

Insulation R-value	Framing Spacing	Reference Name	U-factor
R-14[1]	48 in. o.c.	RP.14.2x4.48	0.064
R-22	48 in. o.c.	RP.22.2x6.48	0.044
R-28	48 in. o.c.	RP.28.2x8.48	0.035
R-36	48 in. o.c.	RP.36.2x10.48	0.029

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

[1] Does not meet the minimum level required as a mandatory measure.

Assumptions:

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, 3/8" of plywood of R-0.47, the insulation / framing layer, 3/8" of plywood of R-0.47, 1/2" gypsum of R-0.45, and an interior air film (heat flow up diagonally) of R-0.62.

Table IV.6 – Standard U-factors for Wood-Framed Floors with a Crawl Space

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY										
			Rated R-value of Continuous Insulation										
			R-0	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10
16 in. OC													
	2 x 6	None (0.0)	**0.099**	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.049
	(3.5 in.)	R-11	**0.050**	0.047	0.045	0.043	0.042	0.040	0.038	0.037	0.036	0.034	0.033
		R-13	**0.046**	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.032	0.031
	2 x 8	R-19	**0.037**	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027
	(7.25 in.)	R-22	**0.034**	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025
	2 x 10	R-25	**0.031**	0.030	0.029	0.028	0.028	0.027	0.026	0.025	0.025	0.024	0.024
	(9.25 in.)	R-30	**0.028**	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022
	2 x 12	R-38	**0.024**	0.023	0.022	0.022	0.021	0.021	0.020	0.020	0.020	0.019	0.019
	(11.25 in.)												
24 in. OC													
	2 x 6	None (0.0)	**0.092**	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048
	(3.5 in.)	R-11	**0.049**	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033
		R-13	**0.045**	0.043	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031
	2 x 8	R-19	**0.036**	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027
	(7.25 in.)	R-22	**0.033**	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.026	0.025
	2 x 10	R-25	**0.030**	0.030	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023
	(9.25 in.)	R-30	**0.027**	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.021
	2 x 12	R-38	**0.023**	0.022	0.022	0.021	0.021	0.020	0.020	0.019	0.019	0.019	0.018
	(11.25 in.)												

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends, which provide positive wood penetration.

Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

Assumptions:

These calculations assume an exterior air film of R-0.17, a vented crawlspace for an effective R-6, a continuous insulation layer (if any), the insulation / framing layer, 5/8" of plywood of R-0.78, carpet and pad of R-2.08, and an interior air film (heat flow down) of R-0.92.

Table IV. 7 – Standard U-factors for Wood Framed Floors without a Crawl Space

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY										
			Rated R-value of Continuous Insulation										
			R-0	**R-1**	**R-2**	**R-3**	**R-4**	**R-5**	**R-6**	**R-7**	**R-8**	**R-9**	**R-10**
16 in. OC													
	2 x 6	None (0.0)	**0.238**	0.191	0.160	0.138	0.121	0.108	0.097	0.088	0.081	0.075	0.070
	(3.5 in.)	R-11	**0.071**	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041
		R-13	**0.064**	0.060	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.039
	2 x 8	R-19	**0.048**	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032
	(7.25 in.)	R-22	**0.044**	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030
	2 x 10	R-25	**0.039**	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027
	(9.25 in.)	R-30	**0.034**	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025
	2 x 12	R-38	**0.028**	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.022	0.022	0.021
	(11.25 in.)												
24 in. OC													
	2 x 6	None (0.0)	**0.199**	0.165	0.142	0.124	0.110	0.099	0.090	0.083	0.076	0.071	0.066
	(3.5 in.)	R-11	**0.070**	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.041
		R-13	**0.062**	0.059	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038
	2 x 8	R-19	**0.047**	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032
	(7.25 in.)	R-22	**0.042**	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029
	2 x 10	R-25	**0.037**	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027
	(9.25 in.)	R-30	**0.033**	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.025	0.025	0.024
	2 x 12	R-38	**0.027**	0.026	0.025	0.025	0.024	0.023	0.023	0.022	0.022	0.021	0.021
	(11.25 in.)												

Based on ASHRAE Parallel Heat Flow Calculation, ASHRAE Handbook of Fundamentals

In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends, which provide positive wood penetration.

Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

Assumptions:

These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), the insulation / framing layer, 5/8" of plywood of R-0.78, carpet and pad of R-2.08, and an interior air film (heat flow down) of R-0.92.

Table IV.8 – Standard U-factors of Metal Framed Walls

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)										
			Rated R-value of Continuous Insulation										
			R-0	R-2	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30
16 in. OC													
	2 x 4	None	**0.457**	0.239	0.162	0.122	0.098	0.082	0.070	0.058	0.045	0.037	0.031
	(3.65 in.)	R-11	**0.202**	0.144	0.112	0.091	0.077	0.067	0.059	0.050	0.040	0.033	0.029
		R-13	**0.193**	0.139	0.109	0.089	0.076	0.066	0.058	0.050	0.040	0.033	0.028
		R-15	**0.189**	0.137	0.108	0.089	0.075	0.065	0.058	0.049	0.040	0.033	0.028
	2 x 6	R-19 1	**0.146**	0.113	0.092	0.078	0.067	0.059	0.053	0.046	0.037	0.031	0.027
		R-21	**0.157**	0.119	0.096	0.081	0.070	0.061	0.054	0.047	0.038	0.032	0.027
	2 x 8	R-19	**0.131**	0.104	0.086	0.073	0.064	0.057	0.051	0.044	0.036	0.031	0.027
		R-22	**0.142**	0.111	0.091	0.077	0.066	0.059	0.053	0.045	0.037	0.031	0.027
		R-25	**0.137**	0.108	0.089	0.075	0.065	0.058	0.052	0.045	0.037	0.031	0.027
		R-30 1	**0.133**	0.105	0.087	0.074	0.064	0.057	0.051	0.044	0.036	0.031	0.027
	2 x 10	R-30	**0.104**	0.086	0.073	0.064	0.057	0.051	0.046	0.041	0.034	0.029	0.025
		R-38 1	**0.119**	0.096	0.081	0.070	0.061	0.054	0.049	0.043	0.035	0.030	0.026
24 in. OC													
	2 x 4	None	**0.452**	0.237	0.161	0.122	0.098	0.082	0.070	0.058	0.045	0.037	0.031
	(3.65 in.)	R-11	**0.172**	0.128	0.102	0.085	0.072	0.063	0.056	0.048	0.039	0.032	0.028
		R-13	**0.164**	0.124	0.099	0.083	0.071	0.062	0.055	0.047	0.038	0.032	0.028
		R-15	**0.158**	0.120	0.097	0.081	0.070	0.061	0.055	0.047	0.038	0.032	0.028
	2 x 6	R-19 1	**0.135**	0.106	0.087	0.074	0.065	0.057	0.051	0.045	0.036	0.031	0.027
		R-21	**0.131**	0.104	0.086	0.073	0.064	0.057	0.051	0.044	0.036	0.031	0.027
	2 x 8	R-19	**0.122**	0.098	0.082	0.070	0.062	0.055	0.050	0.043	0.035	0.030	0.026
		R-22	**0.117**	0.095	0.079	0.069	0.060	0.054	0.049	0.042	0.035	0.030	0.026
		R-25	**0.114**	0.093	0.078	0.068	0.060	0.053	0.048	0.042	0.035	0.030	0.026
		R-30 1	**0.111**	0.091	0.077	0.066	0.059	0.053	0.048	0.042	0.034	0.029	0.026
	2 x 10	R-30	**0.098**	0.082	0.070	0.062	0.055	0.049	0.045	0.040	0.033	0.028	0.025
		R-38 1	**0.097**	0.081	0.070	0.061	0.055	0.049	0.045	0.040	0.033	0.028	0.025

Based on ASHRAE Zone Method Calculation, ASHRAE Handbook of Fundamentals

1 Batt insulation is compressed

Assumptions:

These calculations assume an exterior air film of R-0.17, a 7/8" layer of stucco of R-0.18, building paper of R-0.06, continuous insulation (if any), the insulation / framing layer, 1/2" gypsum of R-0.45, and an interior air film 0.68.

Table IV.9 – Standard U-factors of Metal Framed Roofs with Attics

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)										
			Rated R-value of Continuous Insulation										
			R-0	R-2	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30
16 in. OC													
	2 x 4	None (0.0)	**0.316**	0.194	0.140	0.109	0.090	0.076	0.066	0.055	0.043	0.036	0.030
	(3.65 in.)	R-11	**0.152**	0.117	0.095	0.080	0.069	0.060	0.054	0.046	0.038	0.032	0.027
		R-13	**0.147**	0.114	0.093	0.078	0.068	0.060	0.053	0.046	0.037	0.031	0.027
		R-19	**0.080**	0.069	0.060	0.054	0.049	0.044	0.041	0.036	0.031	0.027	0.023
		R-22	**0.065**	0.057	0.051	0.047	0.043	0.039	0.036	0.033	0.028	0.025	0.022
		R-25	**0.054**	0.049	0.045	0.041	0.038	0.035	0.033	0.030	0.026	0.023	0.021
		R-30	**0.043**	0.040	0.037	0.034	0.032	0.030	0.028	0.026	0.023	0.021	0.019
		R-38	**0.032**	0.030	0.029	0.027	0.026	0.024	0.023	0.022	0.020	0.018	0.016
		R-49	**0.024**	0.023	0.022	0.021	0.020	0.019	0.019	0.018	0.016	0.015	0.014
		R-60	**0.019**	0.019	0.018	0.017	0.017	0.016	0.016	0.015	0.014	0.013	0.012
24 in. OC													
	2 x 4	None (0.0)	**0.316**	0.194	0.140	0.109	0.090	0.076	0.066	0.055	0.043	0.036	0.030
	(3.65 in.)	R-11	**0.134**	0.106	0.087	0.074	0.065	0.057	0.051	0.045	0.036	0.031	0.027
		R-13	**0.130**	0.103	0.085	0.073	0.064	0.056	0.051	0.044	0.036	0.031	0.027
		R-19	**0.074**	0.065	0.057	0.051	0.047	0.043	0.039	0.035	0.030	0.026	0.023
		R-22	**0.061**	0.054	0.049	0.045	0.041	0.038	0.035	0.032	0.027	0.024	0.022
		R-25	**0.052**	0.047	0.043	0.040	0.037	0.034	0.032	0.029	0.025	0.023	0.020
		R-30	**0.042**	0.038	0.036	0.033	0.031	0.029	0.028	0.026	0.023	0.020	0.018
		R-38	**0.031**	0.030	0.028	0.026	0.025	0.024	0.023	0.021	0.019	0.018	0.016
		R-49	**0.024**	0.023	0.022	0.021	0.020	0.019	0.018	0.017	0.016	0.015	0.014
		R-60	**0.019**	0.018	0.018	0.017	0.016	0.016	0.015	0.015	0.014	0.013	0.012

Based on ASHRAE Zone Method Calculation, 2001 ASHRAE Handbook of Fundamentals

Assumptions:

2 x 4 framing is used at the ceiling level

R-13 of insulation is installed between the framing members; above that level, insulation is continuous.

7.25% of the continuous insulation above the framing members is assumed to be at half depth, due to decreased depth of insulation at the edges.

Any rigid continuous insulation is applied under the ceiling framing and above the gypsum board.

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, ½" of plywood of R-0.63, the attic air space (greater than 3.5") of R-0.80, the insulation / framing layer, continuous insulation (if any) 1/2" gypsum of R-0.45, and an interior air film (heat flow up) of R-0.61.

Table IV.10 – Standard U-factors of Metal Framed Rafter Roofs

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)										
			Rated R-value of Continuous Insulation[2]										
			R-0	R-2	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30
16 in. OC													
	2 x 6	None	**0.336**	0.201	0.143	0.111	0.091	0.077	0.067	0.056	0.044	0.036	0.030
		R-11	**0.121**	0.097	0.081	0.070	0.061	0.055	0.049	0.043	0.035	0.030	0.026
		R-13	**0.111**	0.091	0.077	0.067	0.059	0.053	0.048	0.042	0.034	0.029	0.026
	2 x 8	R-19	**0.108**	0.088	0.075	0.065	0.058	0.052	0.047	0.041	0.034	0.029	0.025
		R-21	**0.102**	0.085	0.073	0.063	0.056	0.051	0.046	0.040	0.034	0.029	0.025
	2 x 10	R-25	**0.104**	0.086	0.074	0.064	0.057	0.051	0.046	0.041	0.034	0.029	0.025
		R-30 [1]	**0.094**	0.079	0.068	0.060	0.054	0.048	0.044	0.039	0.033	0.028	0.025
	2 x 12	R-30	**0.073**	0.063	0.056	0.051	0.046	0.042	0.039	0.035	0.030	0.026	0.023
		R-38 [1]	**0.064**	0.057	0.051	0.046	0.042	0.039	0.036	0.033	0.028	0.025	0.022
	2 x 14	R-38	**0.063**	0.056	0.050	0.046	0.042	0.039	0.036	0.032	0.028	0.024	0.022
24 in. OC													
	2 x 6	None	**0.333**	0.200	0.143	0.111	0.091	0.077	0.067	0.056	0.043	0.036	0.030
		R-11	**0.118**	0.095	0.080	0.069	0.061	0.054	0.049	0.043	0.035	0.030	0.026
		R-13	**0.108**	0.089	0.075	0.065	0.058	0.052	0.047	0.041	0.034	0.029	0.025
	2 x 8	R-19	**0.108**	0.088	0.075	0.065	0.058	0.052	0.047	0.041	0.034	0.029	0.025
		R-21	**0.102**	0.085	0.073	0.063	0.056	0.051	0.046	0.040	0.034	0.029	0.025
	2 x 10	R-25	**0.099**	0.083	0.071	0.062	0.055	0.050	0.045	0.040	0.033	0.028	0.025
		R-30 [1]	**0.088**	0.075	0.065	0.058	0.052	0.047	0.043	0.038	0.032	0.028	0.024
	2 x 12	R-30	**0.070**	0.061	0.054	0.049	0.045	0.041	0.038	0.034	0.029	0.025	0.023
		R-38 [1]	**0.061**	0.055	0.049	0.045	0.041	0.038	0.035	0.032	0.028	0.024	0.022
	2 x 14	R-38	**0.060**	0.053	0.048	0.044	0.040	0.037	0.035	0.032	0.027	0.024	0.021

Based on ASHRAE Zone Method Calculation, 2001 ASHRAE Handbook of Fundamentals

[1] Higher density fiberglass batt: R-30 in 2 x 10 rafter cavity is the 8.5" thick batt; R-38 in 2 x 12 rafter cavity is the 10.5" thick batt.

[2] If credit is requested for more than 1.5" of continuous rigid insulation, at least one third of the rigid insulation (up to 2 inches) should be applied to the underside of the rafters.

Assumptions:

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, ½" of plywood of R-0.63, the insulation / framing layer, continuous insulation, 1/2" gypsum of R-0.45, and an interior air film (heat flow up diagonally) of R-0.62.

Table IV.11 – Standard U-factors of Metal-Foam Panel Roof/Ceilings in Residential Buildings

Insulation R-value	Framing Spacing	Reference Name	U-factor
R-14[1]	48 in. o.c.	RP.14.S2x4.48	0.055
R-22	48 in. o.c.	RP.22.S2x6.48	0.039
R-28	48 in. o.c.	RP.28.S2x8.48	0.031
R-36	48 in. o.c.	RP.35.S2x10.48	0.026

Based on ASHRAE Zone Method Calculation, 2001 ASHRAE Handbook of Fundamentals

[1] Does not meet the minimum level required as a mandatory measure.

Assumptions:

These calculations assume an exterior air film of R-0.17, asphalt shingles of R-0.44, building paper of R-0.06, 7/8" of plywood of R-0.80, the insulation / framing layer, 7/8" of plywood of R-0.80, 1/2" gypsum of R-0.45, and an interior air film (heat flow up diagonally) of R-0.62.

Table IV.12 – Standard U-factors for Metal-Framed Floors with a Crawl Space

Spacing	**Framing Type (Actual depth)**	**Cavity Insulation R-Value:**	**OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)**										
			Rated R-value of Continuous Insulation										
			R-0	**R-2**	**R-4**	**R-6**	**R-8**	**R-10**	**R-12**	**R-15**	**R-20**	**R-25**	**R-30**
16 in. OC													
	2 x 6	None (0.0)	**0.095**	0.080	0.069	0.060	0.054	0.049	0.044	0.039	0.033	0.028	0.025
		R-11	**0.065**	0.057	0.051	0.047	0.043	0.039	0.036	0.033	0.028	0.025	0.022
		R-13	**0.062**	0.055	0.050	0.045	0.041	0.038	0.035	0.032	0.028	0.024	0.022
	2 x 8	R-19	**0.062**	0.055	0.050	0.045	0.042	0.038	0.036	0.032	0.028	0.024	0.022
		R-22	**0.065**	0.057	0.051	0.047	0.043	0.039	0.036	0.033	0.028	0.025	0.022
	2 x 10	R-30	**0.055**	0.050	0.045	0.042	0.038	0.036	0.033	0.030	0.026	0.023	0.021
	2 x 12	R-38	**0.044**	0.040	0.037	0.035	0.032	0.030	0.029	0.026	0.023	0.021	0.019
24 in. OC													
	2 x 6	None (0.0)	**0.095**	0.079	0.069	0.060	0.054	0.049	0.044	0.039	0.033	0.028	0.025
		R-11	**0.064**	0.057	0.051	0.046	0.042	0.039	0.036	0.033	0.028	0.025	0.022
		R-13	**0.061**	0.054	0.049	0.045	0.041	0.038	0.035	0.032	0.027	0.024	0.022
	2 x 8	R-19	**0.060**	0.054	0.049	0.044	0.041	0.038	0.035	0.032	0.027	0.024	0.021
		R-22	**0.059**	0.053	0.048	0.043	0.040	0.037	0.034	0.031	0.027	0.024	0.021
	2 x 10	R-30	**0.054**	0.048	0.044	0.041	0.038	0.035	0.033	0.030	0.026	0.023	0.021
	2 x 12	R-38	**0.042**	0.039	0.036	0.034	0.032	0.030	0.028	0.026	0.023	0.021	0.019

Based on ASHRAE Zone Method Calculation, 2001 ASHRAE Handbook of Fundamentals

In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends, which provide positive wood penetration.

Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

Assumptions:

These calculations assume an exterior air film of R-0.17, a vented crawlspace for an effective R-6, a continuous insulation layer (if any), the insulation / framing layer, 5/8" of plywood of R-0.78, carpet and pad of R-2.08, and an interior air film (heat flow down) of R-0.92.

Table IV.13 – Standard U-factors for Metal-Framed Floors without a Crawl Space

Spacing	Framing Type (Actual depth)	Cavity Insulation R-Value:	OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)										
			Rated R-value of Continuous Insulation										
			R-0	R-2	R-4	R-6	R-8	R-1012	R-12	R-15	R-20	R-25	R-30
16 in. OC													
	2 x 6	None (0.0)	**0.253**	0.168	0.126	0.101	0.084	0.072	0.063	0.053	0.042	0.035	0.029
		R-11	**0.106**	0.087	0.074	0.065	0.057	0.051	0.047	0.041	0.034	0.029	0.025
		R-13	**0.098**	0.082	0.070	0.062	0.055	0.050	0.045	0.040	0.033	0.028	0.025
	2 x 8	R-19	**0.100**	0.083	0.071	0.062	0.055	0.050	0.045	0.040	0.033	0.029	0.025
		R-22	**0.106**	0.087	0.074	0.065	0.057	0.051	0.047	0.041	0.034	0.029	0.025
	2 x 10	R-30	**0.083**	0.071	0.062	0.055	0.050	0.045	0.042	0.037	0.031	0.027	0.024
	2 x 12	R-38	**0.059**	0.053	0.048	0.044	0.040	0.037	0.035	0.031	0.027	0.024	0.021
24 in. OC													
	2 x 6	None (0.0)	**0.253**	0.168	0.126	0.101	0.084	0.072	0.063	0.053	0.042	0.035	0.029
		R-11	**0.103**	0.086	0.073	0.064	0.057	0.051	0.046	0.041	0.034	0.029	0.025
		R-13	**0.096**	0.080	0.069	0.061	0.054	0.049	0.045	0.039	0.033	0.028	0.025
	2 x 8	R-19	**0.094**	0.079	0.068	0.060	0.054	0.049	0.044	0.039	0.033	0.028	0.025
		R-22	**0.091**	0.077	0.067	0.059	0.053	0.048	0.043	0.038	0.032	0.028	0.024
	2 x 10	R-30	**0.079**	0.068	0.060	0.054	0.048	0.044	0.041	0.036	0.031	0.027	0.023
	2 x 12	R-38	**0.057**	0.051	0.046	0.042	0.039	0.036	0.034	0.031	0.027	0.023	0.021

Based on ASHRAE Zone Method Calculation, 2001 ASHRAE Handbook of Fundamentals

In order to use the U-factors listed in this section, exterior raised-floor insulation shall be installed between floor joists with a means of support that prevents the insulation from falling, sagging or deteriorating. Two approaches that accomplish this are:

Nailing insulation hangers 18 inches apart prior to rolling out the insulation. Hangers are heavy wires up to 48 inches long with pointed ends, which provide positive wood penetration.

Attaching wire mesh to form a basket between joists to support the insulation. Mesh is nailed or stapled to the underside of the joists.

Assumptions:

These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), the insulation / framing layer, 5/8" of plywood of R-0.78, carpet and pad of R-2.08, and an interior air film (heat flow down) of R-0.92.

Table IV.14 – Standard U-factors for Metal Building[1] Walls

Insulation System	Rated R-Value of Insulation	Overall U-Factor	Rated R-Value of Continuous Insulation								
			R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30
Single Layer of Batt Insulation[2]											
	None	1.18	0.206	0.146	0.113	0.092	0.078	0.063	0.048	0.039	0.032
	R-10	0.134	0.087	0.074	0.065	0.057	0.051	0.045	0.036	0.031	0.027
	R-11	0.123	0.082	0.071	0.062	0.055	0.050	0.043	0.036	0.030	0.026
	R-13	0.113	0.078	0.067	0.059	0.053	0.048	0.042	0.035	0.030	0.026
Double Layer of Batt Insulation[3]											
	R-13 perpendicular / R-10 parallel	0.061	0.049	0.045	0.041	0.038	0.035	0.032	0.027	0.024	0.022
	R-13 perpendicular / R-13 parallel	0.057	0.046	0.042	0.039	0.036	0.034	0.031	0.027	0.024	0.021

[1] A wall must have metal framing no closer than 6 ft on center to use this table. Also, if the wall skin is connected to the girts more frequently than 12 in oc, 0.006 must be added to the U-factor in this table.

[2] Single layer is perpendicular to the girts, between the girts and the outer wall.

[3] First layer is perpendicular to the girts, between the girts and the outer wall. Second layer is inside the framing cavity.

Source: ASHRAE Standard 90.1-2001; NAIMA Compliance for Metal Buildings 1997.

Table IV.15 – Standard U-factors for Metal Building[1] Roofs

Insulation System	Rated R-Value of Insulation	R-Value of Insulation	Rated R-value of Continuous Insulation									
			R-0	R-4	R-6	R-8	R-10	R-12	R-15	R-20	R-25	R-30
Screw Down Roofs (no Thermal Blocks[2])												
	None	0	1.280	0.209	0.147	0.114	0.093	0.078	0.063	0.048	0.039	0.032
	R-10	10	0.153	0.095	0.080	0.069	0.060	0.054	0.046	0.038	0.032	0.027
	R-11	11	0.139	0.089	0.076	0.066	0.058	0.052	0.045	0.037	0.031	0.027
	R-13	13	0.130	0.086	0.073	0.064	0.057	0.051	0.044	0.036	0.031	0.027
	R-19	19	0.098	0.070	0.062	0.055	0.049	0.045	0.040	0.033	0.028	0.025
Standing Seam Roofs with Thermal Blocks[2]												
Single Layer [3]												
	R-10	10	0.097	0.070	0.061	0.055	0.049	0.045	0.040	0.033	0.028	0.025
	R-11	11	0.092	0.067	0.059	0.053	0.048	0.044	0.039	0.032	0.028	0.024
	R-13	13	0.083	0.062	0.055	0.050	0.045	0.042	0.037	0.031	0.027	0.024
	R-19	19	0.065	0.052	0.047	0.043	0.039	0.037	0.033	0.028	0.025	0.022
Double Layer [4]												
	R-10 + R-10	20	0.063	0.050	0.046	0.042	0.039	0.036	0.032	0.028	0.024	0.022
	R-10 + R-11	21	0.061	0.049	0.045	0.041	0.038	0.035	0.032	0.027	0.024	0.022
	R-11 + R-11	22	0.060	0.048	0.044	0.041	0.038	0.035	0.032	0.027	0.024	0.021
	R-10 + R-13	23	0.058	0.047	0.043	0.040	0.037	0.034	0.031	0.027	0.024	0.021
	R-11 + R-13	24	0.057	0.046	0.042	0.039	0.036	0.034	0.031	0.027	0.024	0.021
	R-13 + R-13	26	0.055	0.045	0.041	0.038	0.035	0.033	0.030	0.026	0.023	0.021
	R-10 + R-19	29	0.052	0.043	0.040	0.037	0.034	0.032	0.029	0.025	0.023	0.020
	R-11 + R-19	30	0.051	0.042	0.039	0.036	0.034	0.032	0.029	0.025	0.022	0.020
	R-13 + R-19	32	0.049	0.041	0.038	0.035	0.033	0.031	0.028	0.025	0.022	0.020
	R-19 + R-19	38	0.046	0.039	0.036	0.034	0.032	0.030	0.027	0.024	0.021	0.019
Filled Cavity with Thermal Blocks [2,5]												
	R19 + R-10	29	0.041	0.035	0.033	0.031	0.029	0.027	0.025	0.023	0.020	0.018

[1] A roof must have metal framing no closer than 4 ft on center to use this table. Also, if the roof deck is attached to the purlins more frequently than 12 in oc, 0.008 must be added to the U-factors in this table.

[2] Thermal blocks are an R-5 of rigid insulation, which extends 1" beyond the width of the purlin on each side, perpendicular to the purlin.

[3] One layer of batt insulation laid perpendicular to the purlins.

[4] First layer draped over the purlins, second layer is laid on top of the first layer, parallel to the purlins.

[5] First layer is parallel to the purlins, and supported by a system; second layer is laid on top of the purlins.

Sources: ASHRAE Standard 90.1-2001; NAIMA Compliance for Metal Buildings 1997.

Table IV.16 – Properties of Hollow Unit Masonry Walls

Type			**Core Treatment**		
			Solid	**Partly Grouted with Ungrouted Cells**	
			Grout	**Empty**	**Insulated**
12"	LW CMU	U-Factor	0.51	0.43	0.30
		C-Factor	0.90	0.68	0.40
		Ru	2.0	2.3	3.3
		HC	23	14.8	14.8
	MW CMU	U-Factor	0.54	0.46	0.33
		C-Factor	1.00	0.76	0.46
		R Ru	1.9	2.2	3.0
		HC	23.9	15.6	15.6
	NW CMU	U-Factor	0.57	0.49	0.36
		C-Factor	1.11	0.84	0.52
		Ru	1.8	2.0	2.8
		HC	24.8	16.5	16.5
10"	LW CMU	U-Factor	0.55	0.46	0.34
		C-Factor	1.03	0.76	0.48
		Ru	1.8	2.2	2.9
		HC	18.9	12.6	12.6
	MW CMU	U-Factor	0.59	0.49	0.37
		C-Factor	1.18	0.84	0.54
		Ru	1.7	2.1	2.7
		HC	19.7	13.4	13.4
	NW CMU	U-Factor	0.62	0.52	0.41
		C-Factor	1.31	0.93	0.63
		Ru	1.6	1.9	2.4
		HC	20.5	14.2	14.2
8"	LW CMU	U-Factor	0.62	0.50	0.37
		C-Factor	1.31	0.87	0.54
		Ru	1.6	2.0	2.7
		HC	15.1	9.9	9.9
	MW CMU	U-Factor	0.65	0.53	0.41
		C-Factor	1.45	0.96	0.63
		Ru	1.5	1.9	2.4
		HC	15.7	10.5	10.5
	NW CMU	U-Factor	0.69	0.56	0.44
		C-Factor	1.67	1.07	0.70
		Ru	1.4	1.8	2.3
		HC	16.3	11.1	11.1
	Clay Unit	U-Factor	0.57	0.47	0.39
		C-Factor	1.11	0.78	0.58
		Ru	1.8	2.1	2.6
		HC	15.1	11.4	11.4
6"	LW CMU	U-Factor	0.68	0.54	0.44
		C-Factor	1.61	1.00	0.70
		Ru	1.5	1.9	2.3

	HC	10.9	7.9	7.9
MW CMU	U-Factor	0.72	0.58	0.48
	C-Factor	1.86	1.14	0.81
	Ru	1.4	1.7	2.1
	HC	11.4	8.4	8.4
NW CMU	U-Factor	0.76	0.61	0.52
	C-Factor	2.15	1.27	0.93
	Ru	1.3	1.6	1.9
	HC	11.9	8.9	8.9
Clay Unit	U-Factor	0.65	0.52	0.45
	C-Factor	1.45	0.93	0.73
	Ru	1.5	1.9	2.2
	HC	11.1	8.6	8.6

Notes:

LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90, Calculated at 105 PCF density

MW CMU is a Medium Weight Concrete Masonry Unit per ASTM C 90, Calculated at 115 PCF density

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90, Calculated at 125 PCF density

Clay Unit is a Hollow Clay Unit per ASTM C 652, Calculated at 130 PCF density

Values include air films on inner and outer surfaces.

Calculations based on Energy Calculations and Data, CMACN, 1986

Grouted Cells at 32" X 48" in Partly Grouted Walls

Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada

Table IV.17 – Properties of Solid Unit Masonry and Solid Concrete Walls

Type		**Layer Thickness, inches**									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
LW CMU	U-Factor	na	0.71	0.64	na	na	na	na	na	na	na
	C-Factor	na	1.79	1.40	na	na	na	na	na	na	na
	Ru	na	1.4	1.6	na	na	na	na	na	na	na
	HC	na	7.00	8.75	na	na	na	na	na	na	na
MW CMU	U-Factor	na	0.76	0.70	na	na	na	na	na	na	na
	C-Factor	na	2.15	1.73	na	na	na	na	na	na	na
	Ru	na	1.3	1.4	na	na	na	na	na	na	na
	HC	na	7.67	9.58	na	na	na	na	na	na	na
NW CMU	U-Factor	0.89	0.82	0.76	na	na	na	na	na	na	na
	C-Factor	3.66	2.71	2.15	na	na	na	na	na	na	na
	Ru	1.1	1.2	1.3	na	na	na	na	na	na	na
	HC	6.25	8.33	10.42	na	na	na	na	na	na	na
Clay Brick	U-Factor	0.80	0.72	0.66	na	na	na	na	na	na	na
	C-Factor	2.50	1.86	1.50	na	na	na	na	na	na	na
	Ru	1.3	1.4	1.5	na	na	na	na	na	na	na
	HC	6.30	8.40	10.43	na	na	na	na	na	na	na
Concrete	U-Factor	0.96	0.91	0.86	0.82	0.78	0.74	0.71	0.68	0.65	0.63
	C-Factor	5.22	4.02	3.20	2.71	2.31	1.99	1.79	1.61	1.45	1.36
	Ru	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6
	HC	7.20	9.60	12.00	14.40	16.80	19.20	21.60	24.00	26.40	28.80

Notes:

LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90 or 55, Calculated at 105 PCF density

MW CMU is a Medium Weight Concrete Masonry Unit per ASTM C 90 or 55, Calculated at 115 PCF density

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90 or 55, Calculated at 125 PCF density

Clay Brick is a Clay Unit per ASTM C 62, Calculated at 130 PCF density

Concrete is structural poured or precast concrete, Calculated at 144 PCF density

Calculations based on Energy Calculations and Data, CMACN, 1986

Values include air films on inner and outer surfaces.

Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada

Table IV.18 – Effective R-values for Interior Insulation Layers on Structural Mass Walls

Type Actual	Frame	FURRING SPACE R-VALUE WITHOUT FRAMING EFFECTS																					
Thick		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Any	None	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5
0.5"	Wood	1.3	1.3	1.9	2.4	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	0.9	0.9	1.1	1.1	1.2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
0.75"	Wood	1.4	1.4	2.1	2.7	3.1	3.5	3.8	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.0	1.3	1.4	1.5	1.5	1.6	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1.0"	Wood	1.3	1.5	2.2	2.9	3.4	3.9	4.3	4.6	4.9	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.1	1.4	1.6	1.7	1.8	1.8	1.9	1.9	na	na	na	na	na	na	na	na	na	na	na	na	na
1.5"	Wood	1.3	1.5	2.4	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.5	6.8	7.1	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.6	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	na	na	na	na	na	na	na	na	na
2"	Wood	1.4	1.5	2.5	3.3	4.0	4.7	5.3	5.9	6.4	6.9	7.3	7.7	8.1	8.4	8.7	9.0	9.3	na	na	na	na	na
	Metal	1.1	1.2	1.7	2.1	2.3	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.4	na	na	na	na	na
2.5"	Wood	1.4	1.5	2.5	3.4	4.2	4.9	5.6	6.3	6.8	7.4	7.9	8.4	8.8	9.2	9.6	10.0	10.3	10.6	10.9	11.2	11.5	na
	Metal	1.2	1.3	1.8	2.3	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	na
3"	Wood	1.4	1.5	2.5	3.5	4.3	5.1	5.8	6.5	7.2	7.8	8.3	8.9	9.4	9.9	10.3	10.7	11.1	11.5	11.9	12.2	12.5	12.9
	Metal	1.2	1.3	1.9	2.4	2.8	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8
3.5"	Wood	1.4	1.5	2.6	3.5	4.4	5.2	6.0	6.7	7.4	8.1	8.7	9.3	9.8	10.4	10.9	11.3	11.8	12.2	12.6	13.0	13.4	13.8
	Metal	1.2	1.3	2.0	2.5	2.9	3.2	3.5	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.2	5.3
4"	Wood	1.4	1.6	2.6	3.6	4.5	5.3	6.1	6.9	7.6	8.3	9.0	9.6	10.2	10.8	11.3	11.9	12.4	12.8	13.3	13.7	14.2	14.6
	Metal	1.2	1.3	2.0	2.6	3.0	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.8
4.5"	Wood	1.4	1.6	2.6	3.6	4.5	5.4	6.2	7.1	7.8	8.5	9.2	9.9	10.5	11.2	11.7	12.3	12.8	13.3	13.8	14.3	14.8	15.2
	Metal	1.2	1.3	2.1	2.6	3.1	3.5	3.9	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3
5"	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.3	7.2	8	8.7	9.4	10.1	10.8	11.5	12.1	12.7	13.2	13.8	14.3	14.8	15.3	15.8
	Metal	1.2	1.4	2.1	2.7	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.8
5.5"	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.4	7.3	8.1	8.9	9.6	10.3	11.0	11.7	12.4	13.0	13.6	14.2	14.7	15.3	15.8	16.3
	Metal	1.3	1.4	2.1	2.8	3.3	3.8	4.2	4.6	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.2

All furring thickness values given are actual dimensions

All values include .5" gypboard on the inner surface, interior surface resistances not included

The metal furring is 24" OC, 24 Gage, Z-type Metal Furring

The wood furring is 24” OC, Douglas-Fir Larch Wood Furring, density = 34.9 lb/cu.ft

Insulation assumed to fill the furring space

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada]

Table IV.19 – Properties of Straw Bale Walls[1]

R-value	30
U-factor	0.033
Heat CapacityBtu/ft^2*°F]	2.24

Note:

Framing must not penetrate more than 25% of the way through the straw bale.

Straw bale must have a minimum cross section of 22 in. x 16 in., and shall have a thermal resistance of R-30, whether stacked so the walls are 23 in. wide or 16 in. wide. Due to the higher resistance to heat flow across the grain of the straws, a bale laid on edge with a nominal 16 in. horizontal thickness has the same R-value (R-30) as a bale laid flat.

Table IV. 20 – Standard U-factors for Concrete Raised Floors

OVERALL U-FACTOR FOR ASSEMBLY OF BASE WALL PLUS CONTINUOUS INSULATION (uninterrupted by framing)

	Rated R-value of Continuous Insulation										
	R-0	**R-2**	**R-4**	**R-6**	**R-8**	**R-10**	**R-12**	**R-15**	**R-20**	**R-25**	**R-30**
Continuous Insulation Underneath											
	0.315	0.193	0.139	0.109	0.090	0.076	0.066	0.055	0.043	0.035	0.030
Continuous Insulation Abovedeck1											
	0.253	0.168	0.126	0.101	0.084	0.072	0.063	0.053	0.042	0.035	0.029

1 Above deck case includes a 5/8" layer of plywood between the insulation and the carpet and pad.

Assumptions:

These calculations assume an exterior air film of R-0.17, a continuous insulation layer (if any), the lightweight concrete over metal deck R-0, a continuous insulation layer (if any), 5/8" of plywood of R-0.78 (if continuous insulation above deck), carpet and pad of R-2.08, and an interior air film (heat flow down) of R-0.92.

IV.2 U-factor Calculation Procedures

If a construction assembly is not adequately represented by the lookup tables in Section IV.1, this section may be used to determine assembly U-factors and C-factors. This section may be used only if the proposed building materials differ from the building materials used to derive the U-factors by more than R-2.

A number of methods have been developed to aid in the calculation of U-factors for building envelope construction assemblies. These include the series method, the parallel path method, the transverse isothermal planes method, and the zone method of calculation. Each of these methods has been developed and tested to determine the reliability of matching tested values reasonably well. Alternatively, constructions may be tested for thermal resistance directly using either ASTM C236 or ASTM C976. In order to be considered a valid test, the sample being tested must be representative of the assembly in use. This means including both production line quality of materials and the same framing factors as would be used in the overall assembly including corners or other areas with thermal bridging.

Table IV.21 shows which determination methods may be used for which constructions. Framed assemblies may use the EZFrame computer program available from the CEC. Ordering information is available in Section IV.2.1. The balance of the section shows sample construction assemblies and their U-factor calculations.

Table IV.21 – Allowable U-factor Determination Methods for Construction Types

	Test	EZ Frame	Series Method	Parallel Path Method	Transverse Isothermal Planes	Zone Method
Wood Framed Constructions						
Walls	✓	✓		✓		
Roofs	✓	✓		✓		
Floors	✓	✓		✓		
Metal Framed Constructions						
Walls	✓	✓			✓[1]	✓
Roofs	✓	✓			✓[1]	✓
Floors	✓	✓			✓[1]	✓
Metal Building Constructions						
Metal Building Walls	✓					
Metal Building Roofs	✓					
Masonry and other Unframed Constructions						
Masonry Walls	✓				✓	
Straw Bale and Log Walls			✓			
Below Grade Walls					✓	
Raised Mass Floors	✓				✓	
Slab on Grade Floors						
1 The transverse isothermal planes method may only be used with Commission approved metal framing factors.						

IV.2.1 Computer Modeling of Framed Assemblies

Any framed opaque assembly may use the California Energy Commission developed computer modeling tool, *EZFrame*, to determine assembly U-factors.

EZFrame can be purchased from the CEC publications department by submitting payment and the publication number to the address listed below.

Publication No.: P400-94-002R

Cost: $14.00

Address: California Energy Commission

Publications, MS-13

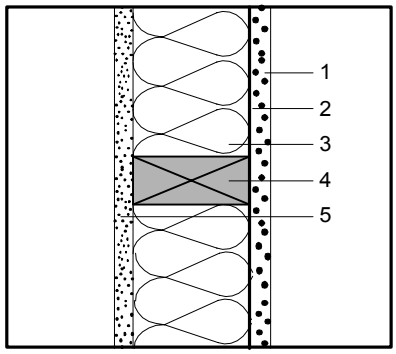
P.O. Box 944295

Sacramento, CA 94244-2950

IV.2.2 Wood Framing

Wood framed constructions may use the parallel path method of calculation. The calculation method is described in detail in Chapter 25 - Thermal and Vapor Barrier Transmission Data in the 2001 ASHRAE Handbook of Fundamentals. Samples of this calculation procedure are included below.

Example IV.1 – Wood Frame Calculation: Parallel Path Method



Sketch of Construction Assembly

Assembly Type:			Floor
(check one)		✓	Wall
			Ceiling/Roof
Framing Material:	**Wood**		
Framing Size:	2 x 4		
Framing Spacing:	16	"o.c.	
Framing Percentage:	Wall:	✓	25% (16"o.c.)
(check one)			22% (24"o.c.)
			9% (48"o.c.)
	Floor/Ceiling:		10% (16"o.c.)
			7% (24"o.c.)
			4% (48"o.c.)
Wall Weight / sf:	NA		
(Packages only)			

	List of Construction Components	R-Value Cavity (R_c)	R-Value Frame (R_f)
	Outside Surface Air Film	0.170	0.170
1.	0.875 in stucco	0.180	0.180
2.	Building paper (felt)	0.060	0.060
3.	R-13 fiberglass insulation	13.000	-----
4.	2x4 in fir framing	-----	3.465
5.	0.50 in gypsum or plaster board	0.450	0.450
6.			
7.			
	Inside Surface Air Film	0.680	0.680
Total Unadjusted R-Values:		14.5405	5.005
		R_c	R_f

$$\frac{[(1/14.540)}{1 \div R_c} \times \frac{(1-25/100)]}{1-(Fr.\% \div 100)} + \frac{[(1/5.005)}{1 \div R_f} \times \frac{(25/100)]}{Fr.\% \div 100} = \mathbf{0.102}$$

Total U-factor

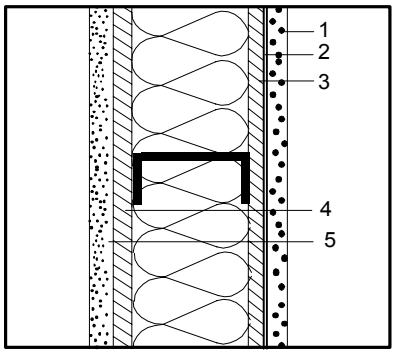
$$\frac{1/0.102}{1 \div \text{Total U-factor}} = \mathbf{9.83}$$

Total R-Value

IV.2.3 Metal Framing

Metal framing calculations may use the *EZ Frame* computer program or the transverse isothermal planes calculation method, provided that Commission approved metal framing factors are used.

Example IV.2 – Metal Framing Calculation: EZ Frame (Zone Method) or Transverse Isothermal Planes



Sketch of Construction Assembly

Assembly Type:		Floor	
(check one)	✓	Wall	
		Ceiling/Roof	
Framing		**Metal**	
Framing	16	"o.c.	
Framing Size:	Actual Depth		6.000
	Actual Width		1.625
Cavity	R-value		19.00
	Knock-out		15.00
	Web		0.060
Insulation Tape	Interior		
	Exterior		

List of Construction Components		**R-Value**	
	Outside Surface Air Film	0.170	
1.	0.875 in stucco	0.180	
2.	Building paper (felt)	0.060	
3.	1.0 in extruded polystyrene	5.000	
4.	1.0 in expanded polystyrene	3.800	
5.	0.50 in gypsum or plaster board	0.450	
6.			
7.			
	Inside Surface Air Film	0.680	
	Subtotal	10.34	R_{st}

EZ Frame Calculation:

From EZFRAME = **0.064** (**Total U-factor**)

1/0.064 = 15.530

1÷Total U-factor = **Total R-Value**

Transverse Isothermal Planes:

Nominal Cavity R-value		19.00	R_c
Metal Framing Factor		0.28	MFF
Effective Cavity/Framing Layer R-value	R_c x MFF	5.32	$R_{c\text{-}eff}$
Balance of Materials – Subtotal		10.34	R_{st}
Total R-value	$R_{c\text{-}eff} + R_t$	15.66	R_t
Assembly U-factor	$1 / R_t$	**0.064**	**Total U-value**

Example IV.3 – Suspended Ceiling with Removable Ceiling Panels[1]

When eligible for Exception to Section 118(e)2 of the Standard, insulation placed on top of a suspended ceiling with removable ceiling panels shall be accounted for in U-factor calculated as in the example below.[2] A parallel path calculation shall be done with one path through the covered section of the ceiling and the second path through the uncovered section of the ceiling; this provides the preliminary assembly U-factor. To account for air leakage through the ceiling tiles, an air leakage U-factor shall be added to the preliminary U-factor to determine the overall assembly U-factor.

Sample U-factor Calculation for Insulation above a Suspended Ceiling with Removable Ceiling Panels

	List of Construction Components	R-Value Covered (R_c)	R-Value Uncovered (R_u)
	Outside Surface Air Film	0.170	0.170
1.	Built – up Roof	0.330	0.330
2.	Lightweight Concrete over Metal Deck	0.00	0.00
3.	12 foot Air Space	0.80	0.80
4.	R-19 Fiberglass Insulation	19.00	----
5.	Removable Ceiling Panel	0.50	0.50
6.			
7.			
	Inside Surface Air Film	0.680	0.680
Total Unadjusted R-Values:		21.48	2.48
		R_c	R_f

$$\frac{[(1/21.48)}{1 \div R_c} \times \frac{(1-25/100)]}{1-(Fr.\% \div 100)} + \frac{[(1/2.48)}{1 \div R_u} \times \frac{(25/100)]}{Fr.\% \div 100} = 0.136$$ Intermediate U-factor

0.005 Air Leakage U-factor

0.141 **Total U-factor**

Table IV.22 – Air Leakage U-factor

	U-factor
Ventilated Air Space	0.275
Unventilated Air Space	0.005

IV.2.4 Masonry and Other

Masonry Walls

For low-rise residential compliance, in order to determine whether a wall qualifies as a "heavy mass" wall for the purposes of complying with Section 151(f)1 of the Standard, the applicable density of the material should be multiplied by the depth of the wall to determine the pounds per ft^2. The densities of common building materials with high thermal mass are listed in Table IV.28. The densities of additional building materials are listed in Table 4 of Chapter 25 of the ASHRAE Handbook of Fundamentals.

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1 The justification for this change appears in Eley Associates, "Limitation of the Use of Lay-In Insulation In Nonresidential Buildings," *Measure Analysis and Life-Cycle Cost: 2005 California Building Energy Efficiency Standards, Part IV*, August 13, 2002, p. 27-63. Presented at the August 27, 2002 workshop.

2 This method of calculating the effect of insulation placed on top of a suspended ceiling with removable ceiling panels shall be used only when there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet.

U-factors and heat capacities shall be taken from Table IV.16 and Table IV.17 above. If interior insulation is added to the masonry wall, effective R-values for the furring/insulation layer may be taken from Table IV.18.

Example IV.4 – Masonry Wall Calculation: Transverse Isothermal Planes

Wall R-value and Heat Capacity

Wall Unit Thickness	6	Nominal Inches
Material Type	Concrete	(LW CMU, MW CMU, NW CMU, Clay Unit, Clay Brick, Concrete)
Core Treatment	na	(Solid, Grouted, Empty, Insulated, NA)
Wall R-value (includes air films)	1.2	R_u (from Table IV.16 or Table IV.17)
Wall Heat Capacity	14.4	HC (from Table IV.16 or Table IV.17)

Exterior Insulation and Interior Furring/Insulation Layers

Exterior Insulation	na	type		
	-	actual inches	-	R_{ext}
Interior Insulation				
Furring Framing Material	metal	(wood, metal, none)		
Furring Framing Size	1”	nominal inches		
	1”	actual inches		
Insulation	bead board	type	3.8	$R_{int-nom}$
			1.68	R_{int}
Total R-value		$R_{ext} + R_u + R_{int}$	2.88	R_t
Total Assembly U-value		$1/R_t$	0.347	

Straw Bale

Properties of straw bale walls shall be taken from Table IV.19.

Log Homes

U-factors for Log Homes may be determined using the series method of calculation. The R-value of the air films and the solid log is added together, and the inverse is taken. R-values and heat capacities shall be taken from ASHRAE 2001 Handbook of Fundamentals, Chapter 25, Table 4.

Concrete Raised Floors

The U-factors for this construction shall be taken from Table IV. 20.

IV.2.5 Assumptions

The assumptions listed in this section shall be used when calculating U-factors using the parallel path, isothermal plane and zone methods of calculation. For calculations, user shall assume a non-reflective surface emittance of 0.90 and winter heat flow direction in determining the R-value of air films and air spaces. These values can be found in Table 1 and Table 3 of Chapter 25 of the ASHRAE Handbook of Fundamentals; they are reprinted in Table IV.23 for convenience. The framing percentages in Table IV.24 shall be used for wood-framed constructions.

Table IV.23 – Standard R-values for Air Films and Air Spaces

	Wall	Roof Flat[2]	Roof 45°angle[3]	Floor
Air Films[1]				
Inside	0.68	0.61	0.62	0.92
Outside	0.17	0.17	0.17	0.17
Air Spaces[4]				
0.5 in.	0.77	0.73	0.86	0.77
0.75 in.	0.84	0.75	0.81	0.85
1.5 in.	0.87	0.77	0.80	0.94
2.0 in.				
2.5 in.				
3.5 in.[5]	0.85	0.80	0.82	1.00

Values from ASHRAE Handbook of Fundamentals, 2001 edition, Chapter 25, Tables 1 and 2.

1. Assumes a non-reflective surface emittance of 0.90 and winter heat flow direction.
2. Use the "Flat" roof R-values for roof angles between horizontal and 22 degrees.
3. Use the "45 degree" roof R-values for roof angles between 23 and 60 degrees.
4. Assumes mean temperature of 90°F, temperature difference of 10°F, surface emittance of 0.82 and winter heat flow direction.
5. Use these R-values for air spaces greater than or equal to 3.5 inches, such as attics.

Table IV.24 – Framing Percentages

Assembly Type	Framing Spacing	Framing Percentages
Roofs	16" o.c.	10 %
	24" o.c.	7 %
	48" o.c.	4 %
Walls – Low Rise Residential	16" o.c.	25%
	24" o.c.	22%
	48" o.c.	9 %
Floors	16" o.c.	10 %
	24" o.c.	7 %

Effective Insulation R-Values

The effectiveness of many types of insulation will be compromised in certain situations, including the compression of fiberglass insulation and the aging of rigid insulation boards filled with a blowing agent. This section delineates the effective R-value for insulation in a number of common situations. The effective R-value listed in this section, rather than the manufacturer's rated R-value, shall be used in these cases.

Aged R-values. In all cases where a manufacturer gives an aged R-value of insulation, the aged value shall be used.

Note: As of January 1, 2003, the rated R-value of polyisocyanurate has decreased due to an industry-wide change in blowing agents.

Compressed Insulation. The effective insulation R-value for uniformly compressed insulation not installed between metal framing members shall be as shown in Table IV. 26.

Insulation Between Metal Framing Factors. The effective insulation R-value for insulation installed between metal framing at 16" or 24" on center shall be the rated R-value of the insulation multiplied by the

applicable metal framing factor in Table IV.25. The effective insulation R-value for insulation installed between metal framing at 48" on center shall be taken from Table IV.27.

Inverted Roofs / Protected Membrane Roofs. A protected membrane roof is a roofing system in which insulation is installed on roofs above the roofing membrane or layer used to seal the roof from water penetration. During rainfall or snowmelt, the movement of water beneath the insulation can increase the heat loss from the roof. Section 118(h) of the Standard limits allowable insulation types in this application. In protected membrane roofs, the effective R-value of rigid board insulation with potential thermal bridges at the joints of the boards shall be reduced by a factor of 0.8. [3]

All Others. Uncompressed insulation not installed between metal framing members and not installed above the waterproof membrane shall be the rated R-value as certified by the manufacturer.

[3] This change is based on: Gary Farber, "Wet Insulation Systems," *Some Outstanding Title 24 Issues for the Next Generation Building Energy Standards (2003/2005),* October 11, 2001. Presented at the October 22, 2001 workshop. Further research is available in J.C. Beech and G.K. Saunders, "The Performance of Lightweight Inverted Flat Roofs," *Symposium on Roofing Technology*, National Roofing Contractors Association, 1985.

Table IV.25 – Metal Framing Factors for Insulation Installed Between Steel Framing

Framing Type	Framing Cavity R-value	Standard Thickness (in.)	16 in. on center Framing	24 in. on center Framing
2 x 4	none	-	0.76	0.79
	11	3.5	0.31	0.39
	13	3.5	0.28	0.35
	15	3.5	0.25	0.32
2 x 6	11	3.5	0.50	0.52
	13	3.5	0.48	0.50
	19	6	0.28	0.31
	21	5.5	0.23	0.29
	22 (compressed)	6.5	0.22	0.27
2 x 8	19	6	0.32	0.35
	21	5.5	0.30	0.34
	22	6.5	0.25	0.32
	25	7.6	0.23	0.29
	30 (compressed)	9.5	0.20	0.25
2 x 10	30	9.5	0.27	0.29
	38 (compressed)	12	0.18	0.23
2 x 12	30	9.5	0.37	0.39
	38	12	0.34	0.36
2 x 14	38	12	0.35	0.37

R-value calculation for Exterior Wall Assemblies with Metal Studs, July 19, 1990, Staff Draft Docket 90-CON-1.

Correction to metal framing factors applies to the insulation/framing layer of the assembly.

Table IV. 26 – Effective R-values for Uniformly Compressed Fiberglass Batt Insulation

	Insulation R-Value at Standard Thickness								
Rated R-Value		**38**	**30**	**22**	**21**	**19**	**15**	**13**	**11**
Standard Thickness (in.)		**12**	**9.5**	**6.5**	**5.5**	**6**	**3.5**	**3.5**	**3.5**
Nominal Lumber	**Actual Depth**								
Size (in.)	**of Cavity (in.)**	**Effective Insulation R-Values when Installed in a Confined Cavity**							
2 x 12	11.25	37	-	-	-	-	-	-	-
2 x 10	9.25	32	30	-	-	-	-	-	-
2 x 8	7.25	27	26	22	21	19	-	-	-
2 x 6	5.5	-	21	20	21	18	-	-	-
2 x 4	3.5	-	-	14	-	13	15	13	11
	2.5	-	-	-	-	-	-	9.8	-
	1.5	-	-	-	-	-	-	6.3	6

Table IV.27 – Effective Insulation / Framing Layer R-values for Roof and Floor Insulation Installed Between Metal Framing (4'0" on center)

Rated R-Value of Insulation	Correction Factor	Framing/Cavity R-Value	Rated R-Value of Insulation	Correction Factor	Framing/ Cavity R-Value
0.00	1.00	0.00	20.00	0.85	17.00
4.00	0.97	3.88	21.00	0.84	17.64
5.00	0.96	4.80	24.00	0.82	19.68
8.00	0.94	7.52	25.00	0.81	20.25
10.00	0.92	9.20	30.00	0.79	23.70
11.00	0.91	10.01	35.00	0.76	26.60
12.00	0.90	10.80	38.00	0.74	28.12
13.00	0.90	11.70	40.00	0.73	29.20
15.00	0.88	13.20	45.00	0.71	31.95
16.00	0.87	13.92	50.00	0.69	34.50
19.00	0.86	16.34	55.00	0.67	36.85

Thermal Resistance and Heat Capacity Properties of Building Materials

The thermal properties of building materials other than insulation shall be taken from 2001 ASHRAE Handbook of Fundamentals, Inch-Pound Edition, Chapter 25, Table 4. Note that insulation R-values shall be determined in accordance with the above Section on effective insulation R-values.

IV.3 Thermal Mass Calculation Procedures

Some compliance options for low-rise residential buildings have prescriptive requirements for thermal mass. This section includes information to determine qualification and sufficiency of thermal mass systems.

According to the definition in the Standards, thermal mass "is solid or liquid material used to store heat for later heating use or for reducing cooling requirements." Common thermal mass materials include concrete, masonry, brick, tile, rock and water. The physical properties of a selection of thermal mass materials are included in Table IV.28.

Unit interior mass capacities (UIMC) values are used to calculate the interior mass capacity (IMC) of a low-rise residential building according to Standards Equation 151-A. The Interior Mass Capacity (IMC) of a material is calculated by multiplying its Area times its Unit Interior Mass Capacity (UIMC). Table IV.29 shall be used when the interior mass is exposed on one side. Table IV.30 shall be used when the interior mass is exposed on two sides. "Exposed" mass means that the mass is directly exposed to room air or covered with a conductive material such as ceramic tile; whereas "covered" mass means that a non-conductive material, including but not limited to, carpet, cabinets, closets or framed walls separates the mass from the room air. Table IV.29 has separate UIMC values depending on whether the mass is exposed or covered.

Table IV.31 contains a complete list of floor coverings that may qualify as *exposed* mass for residential compliance purposes. Table IV.31 also contains recommendations on whether a mass material in a particular application ought to be considered exposed or covered. The intent of these guidelines is to prevent taking thermal mass credit for floor materials that are likely to be covered with carpeting at the time of building occupancy; however, building officials are instructed to allow flexibility for building designs that include radiant floor heating systems and/or that incorporate large areas of uncarpeted slabs in conjunction with south facing glazing as an integral component of deliberately designed passive solar structures.

Table IV.28 – Thermal Mass Properties

Material	***Conductivity (Btu/ hr-ft²-ºF)***	***Density (lb/ft³)***	***Specific Heat (Btu/lb-ºF)***
Adobe	0.33	120	0.20
Heavy Concrete	0.98	140	0.20
Lightweight Concrete	0.36	85	0.20
Gypsum	0.09	50	0.26
Masonry Veneer	0.62	127	0.20
Masonry Infill	0.44	120	0.20
Concrete Masonry Unit	0.59	105	0.20
Grouted Concrete Masonry Unit	1.00	134	0.20
Stucco	0.47	105	0.20
Tile in Mortar	0.67	120	0.20
Solid Wood (Fir)	0.07	32	0.33

Table IV.29 – UIMC Values for Interior Mass[9], when Mass Surface is Exposed on One Side[10]

Material	***Surface Condition***	***Mass Thickness (inches)***	***Unit Interior Mass Capacity***
Concrete	Exposed[1]	2.00	3.6
Slab-on-Grade and		3.50	4.6
Raised Concrete Floors		6.00	5.1
	Covered[2]	2.00	1.6
		3.50	1.8
		6.00	1.9
Lightweight Concrete[8]	Exposed	0.75	1.0
		1.00	1.4
		1.50	2.0
		2.00	2.5
	Covered	0.75	0.9
		1.00	1.0
		1.50	1.2
		2.00	1.4
Solid Wood	Exposed	1.50	1.2
		3.00	1.6
Tile[3,]	Exposed	0.50	0.8
		1.00	1.7
		1.50	2.4
		2.00	3.0
Masonry[4,8]	Exposed	1.00	2.0
		2.00	2.7
		4.00	4.2
Adobe[8]	Exposed	4.00	3.8
		6.00	3.9
		8.00	3.9
Framed Wall	0.50" Gypsum	na	0.0
	0.63" Gypsum	na	0.1
	1.00" Gypsum	na	0.5
	0.88" Stucco	na	1.1
Masonry Infill[7]	0.50" Gypsum	3.50	1.3

Table IV.30 – UIMC Values for Interior Mass[9], when Mass Surface is Exposed on Two Sides[5,10]

Material	Surface Condition	Mass Thickness (inches)	Unit Interior Mass Capacity
Partial Grout	Exposed[1]	4.00	6.9
Masonry[4]		6.00	7.4
		8.00	7.4
Solid Grout	Exposed	4.00	8.3
Masonry[4,6]		6.00	9.2
		8.00	9.6
Adobe	Exposed	4.00	7.6
		12.00	7.8
		16.00	7.6
Solid Wood/	Exposed	3.00	3.3
Logs		4.00	3.3
		6.00	3.3
		8.00	3.3
Framed Wall	0.50" Gypsum	na	0.0
	0.63" Gypsum	na	0.2
	1.00" Gypsum	na	0.9
	0.88" Stucco	na	2.1
Masonry Infill[7]	0.50" Gypsum	3.50	2.6

Notes For Table IV.29 and Table IV.30

1. "Exposed" means that the mass is directly exposed to room air or covered with a conductive material such as ceramic tile.

2. "Covered" includes carpet, cabinets, closets or walls.

3. The indicated thickness includes both the tile and the mortar bed, when applicable.

4. Masonry includes brick, stone, concrete masonry units, hollow clay tile and other masonry materials.

5. The unit interior mass capacity for surfaces exposed on two sides is based on the area of one side only.

6. "Solid Grout Masonry" means that all the cells of the masonry units are filled with grout.

7. The indicated thickness for masonry infill is for the masonry material itself.

8. Mass located inside exterior walls or ceilings may be considered interior mass (exposed one side) when it is insulated on the exterior with at least R-11 insulation, or a total resistance of R-9 including framing effects.

9. When mass types are layered, e.g. tile over slab-on-grade or lightweight concrete floor, only the mass type with the greatest interior mass capacity may be accounted for, based on the total thickness of both layers.

10. Values based on properties of materials listed in 1993 *ASHRAE Handbook of Fundamentals.*

Table IV.31 – Thermal Mass Coverings and Associated Categories

Category 1: Acceptable as Exposed Mass In Any Location. Floor coverings/surfaces determined to be acceptable on any portion of a slab designated as thermal mass in any location within the conditioned space of a residential building.	
Category 2: Acceptable as Exposed Mass Only In Kitchens, Dining Areas that are Extensions to Kitchens, Pantries, Bathrooms, Laundry Rooms, Service Porches and/or Entries. Concrete slabs with Category 2 surfaces must be treated as covered slab in other locations.	
Covering/Surface	Category
Brick	1
Concrete, Exposed Aggregate	1
Concrete, Painted and/or Polished	2
Concrete, Stamped	1
Concrete, Unfinished	2
Hardwood Veneer (except when installed on wood sleepers)	1
Resin-based Poured Flooring	2
Stone or Stone Veneer	1
Sheet Vinyl	2
Tile, Asphalt	2
Tile, Ceramic	1
Tile, Terrazzo	1
Tile, Vinyl	2
Tile, Vinyl-Asbestos	2
Other Masonry Materials with Permanent Finishes Similar to Those Specified in Category 1 and Acceptable to the Building Official	1
1. The intent of these guidelines is to prevent taking exposed thermal mass credit for floor materials that are likely to be covered with carpeting at the time of building occupancy. Building officials should allow flexibility for building designs that include radiant floor heating systems and/or that incorporate large areas of uncarpeted slabs in conjunction with south facing glazing as an integral component of deliberately designed passive solar structures.	

IV.4 ASHRAE 2001 Handbook of Fundamentals, Chapter 25, Thermal and Water Vapor Transmission Data

A reprint of this chapter will be included pending approval from ASHRAE.